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VETERINARY MEDICINE

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The Southern Issue

Bat Rabies in Florida

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Diagnosis of Ringworm in Animals

Problems in Treatment of Pet Birds

(Complete Index on Page VIII)

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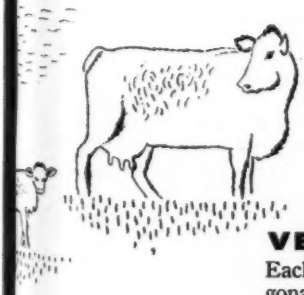

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EDITOR

ROBERT L. ANDERES, B.S., D.V.M.

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REPRESENTATIVE

H. J. Mostyn, P. O. Box 391, Dover, N. J.

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The Southern Issue

IN this, the Southern Issue for 1954, is published a portion of the extensive subject matter presented at the 36th annual meeting of the Southern Veterinary Medical Association which convened at Atlanta, Georgia, on November 9-11, 1953.

Speakers for this program were selected from many parts of the United States to present discussions that covered a wide range of animal disease problems common in the South. Papers presented for publication were especially well developed and prepared. Time did not

Dr. Wm. G. Brock

permit all discussions; neither is there space available to include all papers in a single issue of VETERINARY MEDICINE as has been done for the past two years. Those not included herein will appear in a subsequent issue.

The Southern Veterinary Medical Association, organized in 1916, includes membership of veterinarians of 14 southern states. Membership is automatic for dues-paying members of all of these states. There are no membership dues for the Southern. During its existance, this Association has furnished leadership in all branches of the profession and is supported actively by practitioners, federal and state veterinarians, educators and research men, and public health veterinarians. The scope of interest is apparent at a glance. Professional objectives are directed toward the unification of all segments, and the sharing of intraprofessional problems.

Georgia, host state for this convention, has made remarkable strides toward balanced agriculture. Livestock operations continue to expand there. Income from broilers produced in Georgia now almost equals dollar value of the largest cotton crop ever produced in the state. Legislation for control of disease has kept pace with expanding needs. Dr. T. B. Clower, state veterinarian, supervises sanitary practices at 100 sale barns. New legislation for prevention of spread of vesicular exanthema has added the burden of inspection of garbage feeding establishments of which there are 350 licensed.. Twelve full-time inspectors are assigned to duties concerned with assuring adequate measures of sterilization of garbage and sanitation of premises where cooked garbage is fed. By way of observation, Doctor Clower reported that feeders would continue to cook garbage even if legislation requiring it were repealed.

Featured on the afternoon of the first day's program was a panel discussion of veterinary education and research needs in the South. Those taking part in this interesting discussion included Dr. W. G. Brock, Dr. H. J. Stafseth, Dr. N. G. McGlothlin, Dr. W. B. Bendix, Dr. John R. Walker, and Dr. T. J. Jones. It was

Dr. Clyde W. Young

brought out that young men are not being trained to preceive the problems of disease control on the state level. Doctor Bendix proposed postgraduate training for regulatory work. Doctor Brock discussed the manner of subsidizing young graduates for one year in sparsely settled counties, under guidance of a special department of state extension services.

Health of livestock responsibility, limited opportunities for assistantships and fellowships, and other points pertinent to the future of veterinary medicine in the South were discussed. It was noted by Doctor McGlothlin that education exists to maintain a profession —research to advance it.

President James A. McCallam, representtin the A.V.M.A., was honor guest at the President's Dinner Dance. He presented the subject of public relations at the general session emphasizing the role of the individual in influencing favorable public opinion of the profession.

Dr. A. A. Husman

Officers chosen for the ensuing year are: Dr. William G. Brock, Dallas, Texas, president; Dr. Clyde W. Young, Mockville, North Carolina, president-elect; Dr. Thomas J. Jones, Athens, Georgia, and Dr. E. H. Durr, Jackson, Mississippi, first and second vice-presidents respectively. Dr. A. A. Husman, Raleigh, North Carolina, was reelected secretary.

▼ ▼ ▼

The purpose of periodic veterinary literature is to serve as a link between veterinary science, as it is revealed by research, and application of that science. Its strength depends on the quality of the material and the manner in which it is presented.

No professional man can divorce himself from current literature of his profession and maintain a successful practice built on his responsibility to clients, defined legally as good practice.

▼ ▼ ▼

Progress in poultry production during the past 20 years has been pointed out as a marvel of United States agriculture.

Botulism

The report of Jackson[3] of a suspected case of botulism in dogs raises the question of susceptibility of this species to botulism. Hagan[4] states that, "Sheep, swine, dogs, and cats are resistant to botulism and it is doubtful that natural outbreaks ever occur in these species." Meyer[5] was able to intoxicate dogs fatally with 5,000 guinea pig, ld 50 type A toxin. Meyer was also able to kill dogs with 10,000 guinea pig ld 50 type B toxin. Robinson is stated to have challenged dogs with 50,000 guinea pig ld 50 of the type C beta toxin with no effect. Type C alpha toxin is said to affect only birds. It is usually found in the larvae of blow flies, *Lucilia caesar* or *L. serratica.* There are no reports of type D in this country. According to the South African investigators, it has been found only as the cause of cattle toxemia. There are no reports on the action of type E toxin in dogs.

Recently, Meyer *et al.* reported the first fatal case of type C human botulism. This organism is similar to the South African equine strain type C beta although it has some properties of type C alpha. Meyer states it may be a new subtype. This is the first report of type C toxin producing illness and death in man.

In Jackson's report of canine botulism, it is regrettable that the stomach contents of the sick or dead dog were not available for examination. The dramatic response of the chickens to the polyvalent C botulinus antitoxin would support a diagnosis of type C alpha toxin poisoning in the fowl. It is difficult to determine if the dog had the intoxication on the evidence at hand. Jackson raises the question of how does one diagnose botulism in the dog, which can not be answered on the basis of observations of symptoms. A test can be performed on stomach content in which suitable laboratory animals are inoculated with a filtrate. In addition, attempts to culture *Clostridium botulinum* should be made from the suspected food or environment.

There is a need for investigation of botulism in dogs. It is hoped that reports of such work will be forthcoming.

▼ ▼ ▼

Production of poultry and eggs is the third ranking source of farm income in this country.

[3]Jackson, R. F., Simultaneous Occurrence of Botulism in Dogs and Chickens. *Vet. Med.*, 48:509 (Dec.), 1953.

[4]Hagan, W. A., and Bruner, D. W., Infectious Diseases of Domestic Animals, 2nd ed. Comstock Publishing Co., Ithaca, N. Y., 1951.

[5]Meyer, K. F., personal communication. Dec. 16, 1953.

Bat Rabies In Florida†

JAMES E. SCATTERDAY,* D.V.M., M.P.H., and
MILDRED M. GALTON,** Sc. M., Jacksonville, Florida

THE recovery of rabies virus from insectivorous free-living bats in Florida during recent months has raised many questions in an old, complex problem. The first bat found infected was received on June 25, 1953, by the Tampa Regional Laboratory of the Florida State Board of Health.

The following information concerning this bat was obtained. On June 24, about 10:30 a. m., the seven-year-old son of a rancher was playing in his yard in a remote section of Hillsborough County, 30 miles southeast of Tampa. A bat suddenly flew out of the shrubbery and attacked him, biting him in the upper pectoral region. The bat remained attached to the child until brushed off and killed by his parents. The ranch owner, a Brangus breeder familiar with vampire bat rabies in Mexico, requested that the bat be examined. Accordingly, it was submitted to the Tampa Regional Laboratory, through Dr. C. D. Hopkins of the Hillsborough County Health Department. Direct miscroscopic examination by Mr. Warren Hoffert, bacteriologist, revealed typical Negri bodies. This was confirmed by Mr. Homer D. Venters, director of the Tampa laboratory, and the remainder of the brain was sent to the Jacksonville laboratory for mouse inoculation. After an incubation period of 14 days, the five mice inoculated died with clinical symptoms of rabies. Smears of the mice brains revealed typical Negri bodies. One of these mouse brains was sent to the Virus and Rickettsia Laboratory, Communicable Disease Center, Montgomery, Alabama. Presence of rabis virus was established by complement fixation and serum neutralization tests.

The bat carcass was submitted to Dr. H. B. Sherman, professor of biology, University of Florida, Gainesville, for identification. He reported it to be a lactating female yellow bat (*Dasypterus floridanus*), a species heretofore considered rare.

The boy who was bitten by the bat was given the 14-dose Semple type anti-rabies vaccine and to date has evidenced no symptoms of rabies. The puncture wounds made by the bat's teeth were visible for several days after completion of his treatment.

EDITOR'S NOTE

Bat rabies heretofore has been considered as some rather remote disease condition with which veterinarians need not be concerned immediately. The startling revelation, as outlined in this discussion, suggests the possibility of a new reservoir of virus infection. Facts also have been gleaned in reference to the identity of these free-flying mammals and their habits.

To follow in the forthcoming issue of VETERINARY MEDICINE is a comprehensive Discussion of Bat Rabies in Florida by Dr. Robert D. Courter of the Communicable Disease Center, Atlanta, Georgia, that will serve to supplement this initial report.

Rabies in bats poses new problems of disease control and complicates present ones.

Presented at the Southern Veterinary Medical Association annual meeting, Nov. 9-11, 1953, Atlanta, Ga.

*Public Health Veterinarian, Bureau of Preventable Diseases, State Board of Health, Jacksonville.
**Bacteriologist, Communicable Disease Center, Public Health Service, U. S. Department of Health, Education and Welfare, Atlanta, Georgia, assigned to Bureau of Laboratories, Florida State Board of Health, Jacksonville.

Following confirmation of the diagnosis in this bat, a survey was inaugurated by the Florida State Board of Health to determine the prevalence of rabies in bats in the state. With the cooperation of the Florida Game and Fresh Water Fish Commissioners and the Hillsborough County Health Department officials, bats were collected while feeding at dusk. These bats were shot with shotguns on the ranch where the boy was bitten and in other areas within a 40-mile radius. Further, colony bats from northwest Florida and south Georgia were collected and submitted by Dr. John Wood, biologist, Johns Hopkins University, who is stationed at the Public Health Service Field Station, Thomasville, Georgia.

Early in the investigation it was evident that someone was needed who had a knowledge of the habits and characteristics of bats. The Florida State Board of Health requested aid from the Communicable Disease Center in Atlanta, Georgia. Mr. Colin C. Sanborn, curator of mammals, Chicago Natural History Museum, and Dr. Clarence Sooter, ornithologist, Communicable Disease Center, came to Florida. Mr. Sanborn felt it most important to try to trace the source of the infection. The United States Customs, U. S. Plant Quarantine, and U. S. Animal Quarantine officers were contacted, with negative results. It was then suggested that, Tampa being a banana importing city, vampire bats might have stowed away on some of the incoming ships, thus gaining entry into the state. With this thought in mind, banana importing companies were visited and it was learned from them that due to the way in which bananas are handled the possibility of stowaways was negligible. Men experienced in the loading and unloading of bananas, one with 20 years in the business, were contacted. It was determined from this survey that they all were familiar with the tree mouse, mouse opossum, snakes, and spiders as stowaways among the bananas, but that none of them ever had seen a stowaway bat. There is no evidence to date that the infection is the result of the introduction of rabid vampire bats into Florida.

Brain smears from all bats were prepared and examined microscopically for evidence of rabies. A portion of the brains was then used for mouse inoculation. Specimens showing inclusion bodies were injected into five mice; for those specimens appearing negative, only three mice were used. In present studies, all mice are observed for a period of 40 days. The bats were sent for identification either to Doctor Sherman or Mr. Sanborn, both of whom generously have offered to identify any specimens collected.

TABLE 1. Distribution of Rabies in the Eight Species of Bats Examined in Florida in 1953

SPECIES OF BATS	SOURCE	COLLECTED	POSITIVE
Yellow (*Dasypterus floridanus*)*	Ranch	30	3
Seminole (*Lasiurus seminola*)*	"	39	1
Twilight (*Nycliceius hameralis*)**	"	11	0
Georgian (*Pipistrellus subflavus*)**	"	3	0
Red (*Lasiurus borealis*)*	"	1	0
Big Brown (*Eptesicus f. osceola*)**	"	1	0
Free tail (*Tadarida cynocephala*)**	Building in Plant City	29	0
Yellow	35 mi. NW of Ranch	100	1
Seminole	"	11	0
Yellow	Near Lakeland (around lakes)	8	1
Seminole	"	11	0
Red	"	7	0
Red	40 mi. N. of ranch	1	0
Little Brown (*Myotis austroriparias*)**	Caves near Marianna	75	0
Georgian	"	1	0
Little Brown	Colony in Thomasville, Ga.	54	0
Free tail	"	2	2
TOTAL		384	6

*Noncolonial. **Colonial.
Note: The first positive bat that attacked the child is not included in this table.

In all, 385 bats including eight species have been examined, with six found positive for rabies, as shown in table I. Eighty-five specimens collected from the ranch represented six different species. Of these, three Florida yellow bats and one Seminole bat were found positive for rabies. As previously mentioned, these bats were shot in flight while feeding on insects.

There were 111 bats, including 100 Florida yellow bats and 11 Seminole bats, from an area approximately 35 miles northwest of the ranch. One yellow bat in this group proved positive for rabies.

A total of 26 bats was obtained around two lakes 25 miles northeast of the ranch, near Lakeland. There were eight Florida yellow bats, 11 Seminole bats, and seven red bats. Again, one yellow bat was infected with rabies virus.

Attempts to collect free-living insectivorous bats during the weeks of heavy daily rains were unsuccessful.

Although the majority of the colony bats have been obtained from caves or old buildings, a few were shot in flight. All the five species encountered have been negative by microscopic examination and by mouse inoculation.

Direct microscopic examination of brain smears of the seven positive bats revealed typical Negri bodies in six and atypical inclusions in one. Mouse brains from these seven specimens have been confirmed as positive for the rabies virus by the Virus and Rickettsia Laboratory, Montgomery, Alabama. Of further note is one bat brain which produced typical symptoms of rabies in mice with death in 14 to 21 days, but with no appearance of Negri bodies in the original bat brain or in the first and second mouse passages. This specimen is still under study. Similar instances have been reported by Pawan[1,2] in bats and in cattle.

Although the Florida yellow bat was thought to be rare, it was the species most commonly found in this central Florida area. According to Mr. Sanborn,[3] this bat ranges along the Gulf Coast through Texas and into Mexico. Since little is known of the characteristics and migration habits of this species, it is possible

(*Continued on page 155*)

TABLE 2. Animal Rabies — 1952

County	Species of Animals				Total
	Dog	Cat	Raccoon	Skunk	
Brevard			1		1
DeSoto				1	1
Duval			1		1
Flagler			3		3
Hendry	3				3
Hillsborough	4				4
Holmes	1				1
Leon	1				1
Okaloosa	1				1
Osceola		1	1		2
Pasco	1				1
Pinellas			1		1
Volusia	1				1
Total	12	1	7	1	21

TABLE 3. Animal Rabies — 1953
(January 1 to September 30)

County	Species of Animals						Total
	Dog	Raccoon	Fox	Cattle	Bat	Skunk	
Alachua		1					1
Brevard	1						1
Clay		1					1
Escambia	2						2
Hernando		1					1
Hillsborough	1	1		1	6		9
Jackson	3		6	4			13
Lake	2						2
Marion	1					1	2
Palm Beach	1*						1
Pinellas		1					1
Polk					1		1
St. Johns		1					1
Sumter		1					1
Volusia	1	1					2
	12	8	6	5	7	1	39

*Brought into Florida on a boat from Cuba.

Animal Poisoning And Diagnosis*

JOSEPH E. BURNSIDE, Ph.D., Tifton, Georgia

DUE to the fact that livestock toxicology is becoming more important in our economy, a brief survey of the toxicological diagnostic facilities available to practicing veterinarians was made. Eight specific questions were directed to the heads of departments of veterinary science and animal pathology in the land-grant colleges of the United States. Attention is directed to table I for a summary of these data.

Six states did not honor the questionnaire. Based on information from the veterinary departments which returned the questionnaire, there appears to be inadequate livestock toxicological facilities available.

Attention is invited to the fact that veterinarians in 31 states depend on the cooperation offered by various state agencies such as the state chemist, state feed control laboratory, or the chemistry or agricultural chemistry departments of the state college. Such cooperation is admirable on the part of those concerned, but at the same time, it must be realized that each of the agencies mentioned has its own specific job, and of necessity can not get too involved in livestock toxicological diagnosis. Again, it must be realized that just any laboratory is not usually equipped to handle toxicological analysis. There is specialization in this field as there is in all others. In short, dependence on state agencies, not specifically concerned with livestock toxicological diagnosis, can be most frustrating. This is borne out by the fact that 14 of these states indicate a definite need for either a half-time or full-time† livestock toxicologist.

As a matter of interest, it should be stated that seven states indicated they received a large amount of help from respective state crime laboratories. These laboratories are usually confined by law to accept only toxicology cases involving criminal intent which, of course, deals mostly with human toxicology. The remaining 35 states reported either never having requested help from this source or the requests being answered in the negative.

The author has found that a somewhat specific set of directions, on the submitting of toxicological samples, is of value to the practicing veterinarian. Such directions should be used as a guide, not slavishly followed or disregarded completely. However, it was found that only 16 states had taken this step. It appears that more thought should be given to such an important matter since the first step in a successful laboratory diagnosis is a satisfactory sample.

The death of an animal from an unknown cause is not sufficient reason to suspect poisoning. An alarming number of so-called poison cases are the result of imagination, suspicion, and an endeavor on the part of some veterinarians to satisfy the whim of an otherwise good client. Some suspected poison cases are of such a petty nature that they should not be considered even as prospects. It is the responsibility of the practitioner to exercise extreme caution and diligence in submitting samples for diagnosis. He must cull his cases carefully. This is perhaps the foremost reason why such a service must be channeled through veterinarians.

Several states indicated they had established a toxicology service in the past, but that it had been discontinued. In these instances, samples were sent to the chemistry department of the state university and a small fee was charged. The understanding was that the client bear the expense. This situation was taken advantage of quickly in that the university could not collect the fee in a number of cases. This tendency became more pronounced. It then became necessary to discontinue service on this basis and refer clients of the veterinarian to a commercial laboratory. The clients, as a whole, quickly lost interest when payment had to be made in advance. Diagnostic service cannot be made the victim of a "pass the buck" attitude and still function efficiently. Because of the foregoing, a large number of states are reluctant to initiate livestock toxicology diagnosis service. Specimens should be submitted for a toxicological

*Contribution of the Department of Animal Diseases, Georgia Coastal Plain Experiment Station. Published with the approval of the Resident Director as Journal Series Paper No. 22.
Presented at the Southern Veterinary Medical Association annual meeting, Atlanta, Ga., Nov. 9-11, 1953.
†Time not actually spent in diagnostic work would be used for toxicological research.

diagnosis only when there are definite indications of some type of poisoning, *i.e.*, lesions, symptoms, history, and the potential economic loss warrants it.

This necessitates spending what might be considered an abnormal amount of time with a suspected poison case. Nevertheless, one hour spent with a client might save a day of expensive laboratory procedure on the part of the toxicologist.

The similarity of some disease symptoms to those of poisoning are well established but are often disregarded. At the same time, certain postmortem appearances are helpful as general aids to diagnosis. These observations must not be overlooked. The following few examples will serve to illustrate the former. Purging and abdominal pain is associated with poisoning due to arsenic, barium, mercury, phosphorus, veratrum, and some acids and alkalies. Gastritis, gastroenteritis, gastric and duodenal ulcers also are associated with these symptoms.

Some poisons which cause convulsions are the various plant alkaloids, lead, strychnine, nicotine, and, to a lesser degree, hydrogen cyanide. Diseases which give symptoms that may be confused with those produced by these poisons are tetanus, rabies, Aujeszky's disease, various dog distempers, and encephalitic disturbances.

Postmortem lesions suggestive of a metal poisoning are a generalized or localized inflammation of the stomach and intestinal tract, ulcerations with or without a granular deposit in the center, submucosal hemorrhage, and perhaps hemorrhage in the epicardium and endocardium. A large deposit of a thick, sticky mucus is usually present on the walls of the stomach and intestinal tract.

When the stomach contents has a greenish hue, exhibits a luminosity, a garlicky odor, or an odor of bitter almonds, it suggests poisoning due to paris green (copper-arsenate compound), phosphorus, arsenic, and hydrogen cyanide respectively. When the blood is disorganized and has a chocolate appearance, potassium chlorate or a nitrate compound is suspected as the toxic agent. When putrefaction is markedly delayed, poisoning due to arsenic or mercury may be responsible. On the other hand, an apparently rapid putrefactive process would suggest the presence of phosphorus. The presence of strychnine, of course, is indicated by a protracted rigor mortis.

Again it must be emphasized that the foregoing "clues" are merely suggestive of a particular group or type of poison and are not to be used as a basis for an absolute diagnosis.

When the veterinarian has a bona fide toxicology case, there are several distinct steps which he must take to assure the toxicologist of a satisfactory sample. These can be mentioned only briefly in this paper. An adequate sample of the proper tissue frequently is not provided. Generally speaking, stomach contents, liver, and at least one kidney should be submitted. One-half to 1 kg. of the first two substances should be submitted for large animals, and all available for small animals. There is hardly any excuse for inadequate samples when the veterinarian has an entire animal at his disposal.

Preservation of the sample should be considered, especially in cases dealing with an organic poison. Samples are best shipped packed in dry ice or in an iced vacuum jug. If the distance involved is not too great, simply freezing the sample and insulating with paper will assure its safe arrival. If these methods can not be employed, 1 ml. of chemically pure ethyl alcohol per gm. of tissue may be used as a preservative. A separate sample of the alcohol should be included as a check for contaminants.

The shipping container should be chemically clean and protected from possible breakage enroute. If a metal lid is used on the container, the contents should be protected in such a way that it does not come in direct contact with the metal. Clean cellophane or plastic bags have been used with satisfactory results and, in some instances, are better than glass jars. The container also should be clearly labeled as to contents, veterinarian, and owner. Above all, each sample should be in a separate container and stomach contents not mixed with liver or kidney.

If possible, a transportation schedule should be selected that will allow an uninterrupted delivery. This is particularly significant when shipped *via* bus line, or when a week end or holiday is approaching.

A complete history of feeding practices, environment, symptoms, postmortem lesions, and any unusual findings should accompany samples. This is particularly important and is oftentimes either entirely overlooked or very sketchily provided. This information is what the toxicologist uses as a basis for differential analysis in lieu of a specific analytical request.

The remainder of this paper will be devoted to some of the more simple presumptive toxicological tests that the veterinarian or veterinary diagnostic laboratory can perform.

Nitrate Poisoning

Under special conditions, animals may suffer nitrate poisoning from inorganic sources as well as from plants. In either case, the nitrate is reduced to nitrite which is then absorbed into the blood stream and converts hemoglobin to methemoglobin. Experimental evidence has shown that plant nitrate can be changed to nitrite under proper conditions of moisture and oxygen. The maximum production of nitrite takes about 20 hours. An apparently innocuous or borderline quantity of plant nitrate can be toxic in 18 hours due to reduction to nitrite. Such has been the case in several recorded instances.

Nitrate Tests

Reagents.

1. 0.25% solution of diphenylamine in H_2SO_4.

2. Brucine of highest purity.

3. Sulphuric acid and distilled water.

Procedure.

1. Mix about ½ pint of rumen contents (including fluid) with enough distilled water to give a heavy slurry. The amount of water should be kept to a minimum so the nitrate will not be diluted unduly.

2. Let stand for about 30 minutes and strain through closely woven muslin. This may be hurried somewhat by lightly squeezing the material. The liquid thus secured is slightly green and turbid.

3. Filter through a fine filter paper (preferably a Whatman 42) and secure about 1 ml. of clear liquid.

(a) Diphenylamine Test for Nitrates.

1. Add 2-3 drops of this reagent to 6-8 drops of rumen extract. A light blue color to a heavy blue precipitate indicates the presence of nitrates. Let stand for at least 30 minutes before assuming negative reaction. This reaction should be observed against a white background, *e.g.*, spot plate.

(b) Brucine Test for Nitrates.

1. Add 2-3 small crystals of brucine to 6-8 drops of rumen extract and then add 3 drops of H_2SO_4.

2. A light red color to a heavy red precipitate indicates a positive test. Let stand for 30 minutes before assuming a negative reaction.

Hydrogen Cyanide (Prussic Acid) Poisoning

The most prevalent form of cyanide poisoning in livestock is due to ingestion of cyanogenetic glucosides of which amygdalin is the most common. Amygdalin is acted on by emulsin, an enzyme mixture, to produce free HCN. Plants that contain only the glucoside must be considered as a potential source of HCN poisoning because animals may consume other plants which contain emulsin. The plants which usually produce HCN poisoning in animals contain both the enzyme necessary to liberate HCN as well as the glucoside amygdalin. A fact not generally known is that the seeds of peaches, plums, apricots, apples, and cherries contain amygdalin in sufficient quantities to liberate 0.13, .05, 0.03, and 0.8% HCN respectively. Cyanide poisoning in man has been reported due to consumption of the above seeds in excessive quantities. No attempt will be made to list all of the plants that are a potential HCN threat to the livestock producer.

Of the tests that the practitioner can run, the HCN test is probably the most important. This is due to the low boiling point of the compound (26.5 C.) and the rapidity with which it passes into the atmosphere. Samples submitted must be taken immediately after autopsy and properly preserved. Failure to do this may yield false negatives. A potential source of false positives is putrefaction. In a 24-hour period, putrefaction may have occurred to the extent that the HCN produced by microorganisms will give a positive reaction. This HCN may diffuse from the rumen and be absorbed by the liver to give a false positive in this organ also.

The best substances to test for HCN are a composite sample of rumen contents or a portion of the right half of the liver. It is important to get a composite sample of rumen contents as the concentration varies greatly from one location to the other. From the foregoing it readily can be seen that samples for HCN analysis must be secured immediately after postmortem and must be kept in sealed glass containers, under refrigeration, until ready for analysis.

HCN gives off an odor resembling bitter almonds. When moderate amounts of this gas are present, it is possible to detect it by this odor, however, this cannot be taken as positive proof.

Tests for Hydrocyanic Acid

Reagents.

1. Take 5 gm. of Na_2CO_3 and 0.5 gm. of picric acid made up to 100 ml. with water. This may be kept for four months if well stoppered and kept cool.

2. Chloroform.

3. A 0.2% solution of gum guaiacum resin in ethanol.

4. A 0.1% solution of copper sulfate.

5. Distilled water.

Procedure. Picrate Test.

1. Rumen contents and/or finely diced pieces of the right half of the liver are placed in a flask and enough water added to make a slurry.

2. Strips of filter paper are saturated with the Na_2CO_3-picric acid solution and allowed to become almost dry.

3. One end of these picric acid strips (at least two) are placed in a split cork stopper and the stopper carefully inserted in the flask without letting the strips touch the sides of the flask. A blank is usually run on another sample at the same time.

4. Carefully warm the flask, thus stoppered, to 30-35 C. If a large amount of cyanide is present a positive reaction will be noted within one to 15 minutes, as denoted by the picrate paper turning various shades of red. Let the reaction continue at least three hours before assuming a negative reaction.

5. Picric acid strips may be prepared, dried and placed in stoppered vials for immediate use. Strips so prepared lose sensitivity after one week and should be discarded. If such strips are used, they should be moistened with distilled water before using.

Gum Guaiacum Test.

1. Proceed in same manner as picrate test except make filter paper test strips immediately prior to use.

2. Moisten strips with ethanol solution of gum guaiacum and then with copper sulfate solution. This is done by having each solution in screw-cap dropping bottles and applying each solution in large drops.

3. A positive reaction is characterized by strips turning a baby-blue color. Always run a blank as in picrate test. These two tests are so sensitive that if they are negative the absence of cyanide in the sample tested is unequivocally proved.

4. Both of these tests may be readily carried out in a large test tube and incubated under the arm when in the field.

Test for HCN in Plant Material.

1. To a test tube, or small flask, add a couple of grams of moist, shredded, plant material or crushed seed and 4 drops of chloroform.

2. Insert picrate or guaiacum test paper and proceed as in above tests.

3. If the test is negative, this suggests the absence of a cyanogenetic glucoside or that a hydrolyzing enzyme is not closely associated with it.

Arsenic Poisoning

Several good tests for arsenic are available to the veterinarian. These tests deal with arsenic in biological material as well as in granular material. When several simple precautions are observed they are reliable and delicate.

Reinsch Test

Reagents.

1. Two to 8% reagent grade hydrochloric acid. This is readily prepared by cautiously adding 10 ml. of reagent grade HCl to 90 ml. of double-distilled water (arsenic free).

2. A 1:1 solution of HNO_3 for cleaning copper strips.

3. Double distilled water, ethanol, and ether for washing copper strips.

4. Several pieces of copper, 1 cm. square. These may be cut from a sheet of copper secured from local hardware stores.

5. A standard arsenic solution of As_2O_3 containing about 10 gamma of arsenic per ml. The As_2O_3 is dissolved with 20% NaOH and made to volume with double distilled water. Suitable dilutions can be made from a standard stock solution containing 1 mg. of arsenic per ml. It is best to use all pyrex glassware in this determination.

Procedure.

1. Place finely minced liver, or stomach contents, in appropriate size Erlenmeyer flask or large test tube, in duplicate. Add a sufficient quantity of the HCl to make a fluid mixture.

2. At the same time, add the same amount of prepared HC1 to two more containers; one of these to be used as the negative control, and the other as the positive control.

3. Add 50 or 100 gamma of arsenic to the positive control (100 gamma is suggested; however, 50 gamma may be readily detected with experience).

4. Bring flasks to a slow boil and keep volume constant by small additions of the prepared HC1 solution. Allow flasks to react for about 20 minutes. In this way any sulfur, which may give a false positive, is reduced to a minimum.

5. Clean copper squares by immersing in

the prepared HNO_3 solution, (they should be a bright, brick-red color). Thoroughly wash with water and alcohol as the presence of any oxidizing substance will prevent the arsenic from being deposited on the copper.

6. Place a copper square in each flask and let reaction go for at least 45 minutes before assuming a negative. Of course, each test must be interpreted in light of positive and negative control. The arsenic seems to be deposited better if the copper is held in a vertical position by a thin copper or platinum wire attached to one corner.

If the sample contains a large quantity of arsenic, it will be deposited in large pieces, which usually flake off, giving the appearance of a negative reaction. This is rare, nevertheless it happens. Inspect the copper at frequent intervals, (a strong positive usually takes about 15 to 20 minutes). When a positive reaction is certain, the slurry may be decanted, the copper thrown on a paper towel and washed with water, ethanol, and ether while holding one corner of the copper strip with forceps. Do not touch copper with fingers. The copper may be cleaned and used repeatedly.

Arsenic, antimony, and bismuth give a black or dark purple deposit, while a grey or silvery deposit indicates mercury or silver. Arsenic and mercury are the only metals commonly involved in livestock toxicology. Good tests are available for confirmation of arsenic and mercury, however, the main value of this test in the hands of a practicing veterinarian is to eliminate these metals.

A negative test suggests either the absence of, or the presence of, only minute quantities of said metals.

Silver Mirror Test

This is an excellent test for any arsenic compound which is a solid, or contained in a mixture of solids.

Reagents.

1. A flux consisting of a mixture of three parts of Na_2CO_3 and one part KCN ($3Na_2CO_3$:1KCN).

Procedure.

1. A small amount of the substance to be tested is placed in a small, clean, dry, pyrex test tube. To this amount is added approximately six times as much flux.

2. The upper part of the tube may be drawn out or left as is. It is best usually to draw the tube out, as this makes small amounts of arsenic more easily detected.

3. Gently heat the upper portion of the tube, to drive off any moisture, and let this cool for several minutes. Heat the flux until most of it is melted, then shift the tube so the suspected arsenic compound is heated, then heat the entire end of the tube at the same time.

4. Any arsenic compound present is reduced to metallic arsenic and is deposited on the upper cool portion of the tube in the form of an arsenic mirror. The mirror will extend around the tube and each end will show gradations of black to brown shading.

If the heating is too vigorous, or the diameter of the tube is too large, a poor mirror will be formed.

Penicillium brevicaule Test

This test is a biological test and is for arsenic compounds in general, but is used mostly for detection of the metal in biological materials.

Reagents.

1. Pure culture of *Penicillium brevicaule* obtained from the American Type College Collection, Washington 25, D. C.

2. Sterile potato agar or Czapek Dox slants. Keep good stock cultures, containing large quantities of spores, on hand. Subculture in triplicate each time a tube is used to inoculate a test.

Procedure.

1. Mix about 5 gm. of suspected material or 3 ml. of urine with 10 gm. of raw potato or an adequate amount of Czapek Dox media. The urine should be neutralized with calcium carbonate, citric, or tartaric acid for best results. Sterilize at 15 lb. pressure for 15 minutes. At the same time, prepare a positive and negative control in duplicate.

2. When sterilized and cooled, inoculate the three sets of tubes with spores from a subculture and incubate at 32 C. for 12-72 hours.

3. A positive test is indicated by the intense, garlicky odor of diethylarsin. The odor of this gas can be detected for about a week with 100 gamma of arsenic. Thirteen other molds are known to give the reaction but this is the best one to use.

Useful Test for Strychnine

Reagents.

1. Approximately 0.1 normal hydrochloric acid.

(*Continued on page 146*)

Vesicular Diseases†

C. J. MIKEL, D.V.M., Atlanta, Georgia

THE title, Vesicular Diseases, is broad. This discussion will be limited to the vesicular diseases of interest at the present time from a control and eradication standpoint, *viz*: vesicular exanthema, foot-and-mouth disease and vesicular stomatitis, and the intent is to give information of significance now.

When a vesicular disease occurs, or is suspected, it must be handled as foot-and-mouth disease until its positive identity is established. Veterinarians handling, reporting, and advising others concerning an outbreak should act on that basis. Understandably, vigilance and cooperation of all veterinarians toward reporting and applying proper measures of control and containment are sought. Such support has been, and is now, given continually. It is believed that such cooperation is always available and can be had simply by providing veterinarians with information regarding plans and measures which apply to these diseases and by inviting them to participate in control and eradication.

Preceding and through the year 1929, foot-and-mouth disease occurred in the United States eight times. In round figures, eradication has cost $17,000,000. and losses attending these outbreaks have been estimated at more than $300,000,000. Also, it has been estimated that to have foot-and-mouth disease in the United States would cost at least $200,000,000. annually through diminished production and income. For several years before it appeared in Mexico late in 1946, this country was not subject to obvious threat of the disease. After a broad and vigorous eradication and control program in Mexico, the disease was eliminated, and restrictions on livestock and related products imported from Mexico were lifted on September 1, 1952. On May 23, 1953, another outbreak occurred. Eradication and control measures are again under way in Mexico and, of course, import restrictions are again applied. The Mexican border patrol of the Bureau of Animal Industry, which was reduced to a skeleton force after the Mexican import restrictions were lifted, now has been restored to effective strength. As you will recall, foot-and-mouth disease was diagnosed in Canada in February 1952 and was eradicated by the following August. Our import restrictions applying to countries where foot-and-mouth disease exists, and as applied to Canada, were lifted on March 1, 1953.

Severe outbreaks occurred in central and western Europe in 1949 and in 1951. France, during the period July to December 1952, reported over 3,000,000 cases involving 249,000 farms, constituting the worst epizootic in that country during this century. Since then incidence has declined in France. Great Britian had its first outbreak in connection with this particular sweep in November 1951. Thus began the worst epidemic of foot-and-mouth disease in the British Isles in many years, increasing in fury in 1952 and declining in 1953. Hungary simply reports that foot-and-mouth disease occurs extensively there. Finland, free from the disease from 1941 to 1952, reported outbreaks in December 1952 affecting thousands of animals. The disease was reported for the first time in modern history on the Isle of Jersey in 1952. There, eradication measures similar to those found effective in the United States and Canada were employed.

These outbreaks have been caused by A, O, and C types of the virus and, in addition, by a variant of the A type known as A-5. The A-5 variant appeared in the 1951 outbreaks in Germany, Holland, Belgium, Luxemburg, France, Italy, Denmark, Sweden, Great Britain, and Norway. A-type vaccines used in these outbreaks did not provide protection. This information, and the fact that foot-and-mouth disease always is present in South American countries, Asia, and Africa, is given to indicate our position relative to the possibility of disease appearing at any time in the United States.

Vesicular Exanthema

Modern transportation has made the world a small place. The United States and Canada combined comprise one of the few large land areas where foot-and-mouth disease does

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not exist at the present time. Realizing our position realtive to foot-and-mouth disease, let us review the vesicular disease situation in the United States. We are now well into the second year of widespread outbreaks of vesicular exanthema, first occuring in Nebraska in June 1952. It has been present in California since 1933, at which time it was recognized to be a distinct disease entity. Circumstances indicate that the present outbreak virus came from California. Forty-one states and the District of Columbia have been involved with parts of as many as 22 states being under quarantine at one time. During the period immediately following the Nebraska outbreak, most of the major stock yards were contaminated by infected hogs, some more than once.

Vesicular exanthema in swine. Vesicle may be noted (circled) on foot at right. Raised area is whitened. Such areas may partially or completely encircle the hoof. Lesions after rupture of vesicles may be noted on both feet.

The over-all spread and occurrence of vesicular exanthema has been considered to be divided into two phases. The first was by the movement of infected and exposed animals in normal trade channels during the first few months of the outbreak. The second phase has been thought of as due to feeding garbage. Outbreaks continued occuring after cleaning, disinfecting, and other control measures were taken, and after close inspection of hogs moving in trade channels. Apparently considerable numbers of swine were slaughtered when affected with the disease in a mild form or in a stage where not detected. The virus in garbage from these swine appears to have been the means of widespread dissemination. Through August 26, 1953, vesicular exanthema was reported to have occured in 522 garbage-fed herds, in 50 grain fed herds, and 234 lots of hogs in serum plants, stockyards, and packing plants. At present all of California and counties (or parts of counties) in Massachusetts, Maine, Connecticut, New Jersey, New York, Pennsylvania, South Carolina, and Texas are under quarantine. (November 10, 1953).

Many regional and several national meetings have been held by representatives of the various segments of the swine industry to consider the problems posed. State laws, state regulations and federal regulations which are adequate for control of this disease have come into existence. Federal regulations control the movement of swine and pork from state to state and stipulate how conveyances and facilities shall be cleaned and disinfected relative to the possibility of disease spread. State laws and reglations provide for cooking and proper handling of garbage fed to swine and for regulating the movement of swine intrastate. Such state laws and/or regulations now exist in 41 states. Semimonthly inspections of garbage feeding operations are now being carried out in 22 of these states.

Vesicular Stomatitis

The third disease with which we are concerned is vesicular stomatitis. It occurs in many states and, ordinarily, has affected cattle and horses only. In Georgia, and in one instance in North Carolina, vesicular stomatitis has affected swine. We have had repeated outbreaks in southeast Georgia in an oval-shaped area comprised of most of six counties and measuring approximately 140 miles by 50 miles. Positive diagnoses were made on three premises in 1952 involving more than 1,000 head of swine and on ten premises in 1953 involving approximately 700 animals. These outbreaks occurred during May, June, July, and August of both years. The area in which they occurred is heavily wooded except for cultivated

land. Much of the land adjacent to creeks and rivers is swampy. Open range conditions prevail so that livestock intermingle regardless of ownership. Even though there were cattle and mules on eight of the 13 premises where vesicular stomatitis was diagnosed, it was observed to have affected cattle in only one instance.

Many primary investigations have been required to handle reported suspicious disease in the area thus involved. Information obtained from veterinarians, livestock owners, game wardens, and others familiar with this area over a lengthy period, rather conclusively indicates that vesicular stomatitis has occurred in swine and in other animals there for at least 15 years, possibly longer. Accounts were given of deer being affected, in addition to swine and cattle. The horse and mule population in the area is limited and, for the most part, mules predominate. No reports of horses or mules being affected have been received, even though infection would seen likely among these animals.

Foot-and-mouth disease. Ravages of this disease among cattle where epizootics occur make necessary severe control measures applied to all vesicular diseases of livestock.

The Animal Disease Station at Beltsville, Maryland, by serology applied to virus-carrying tissues and blood samples from outbreaks and test animals, determined that the New Jersey type virus was the causative agent.

Different Symptoms and Lesions

The similarity of these three vesicular diseases is responsible for difficulties in diagnosis and control. Both foot-and-mouth disease and vesicular exanthema are described as viral, acute, febrile, highly contagious, and infectious. Vesicular stomatitis may be described in the same manner although it is not as contagious and infectious as the other two. All three are characterized by formation of vesicles, ordinarily preceded and accompanied by high temperature elevations. Temperatures of 108 F. are recorded for swine affected with vesicular exanthema and foot-and-mouth disease. Temperatures of 107 F. have been found repeatedly in Georgia swine affected with vesicular stomatitis. Species affected, location of lesions, rate and extent of spread, and the virulence indicate to some extent which disease is involved in an outbreak; also, these factors can be misleading. Swine affected with vesicular exanthema have vesicles on the snouts, lips, gums, feet, and, in some instances, on teats and udders. Vesiculation both in the mouth area and on the feet may not occur. In other words, in an outbreak there may be a tendency toward only foot lesions or only snout lesions. The same is true in the instance of outbreaks of vesicular stomatitis. Vesicular stomatitis in horses and cattle affects only the tongues, gums, and lips except in rare instances. Vesicles found in outbreaks of foot-and-mouth disease affect the mouth area, feet ,and udder and teats in many instances.

Virus is discharged by the infected animal from the time of marked temperature elevation until several days after vesicles have ruptured. This virus is discharged through the body secretions and excretions as well as by open vesicles. Foot-and-mouth disease spreads rapidly and may be expected to infect a large percentage of animals exposed. Vesicular exanthema may vary from a mild infection to a virulent one affecting 100% of lots and herds in which it occurs. Vesicular stomatitis usually does not affect more than 60% of the group in which it is found and, in many instances, affects only small numbers in individual herds.

Differential diagnoses made on premises where outbreaks occur are required for proper handling of these diseases. Strict quarantine measures are applied and test animals are inoculated. The conclusions drawn from the use of test animals may be further supported or checked by serological tests. I believe veterinarians are familiar with the susceptibility of the various species of animals to these three diseases and the way in which such susceptibility is used to determine which of the diseases has occurred in a given outbreak. The accompanying chart lists these three diseases with susceptibility of horses, cattle, and swine to each. Note that the cow is susceptible to foot-and-mouth disease and vesicular stomatitis and that foot-and-mouth disease can be transmitted to

	Swine (snouts)	Cow i.d.l.	Cow i.m.	Horse i.d.l.
VS	+	—	—	∓
F & M	+	+	+	—
VS	+	+	—	+

i.d.l. = intradermal-tongue, n.m. = intramuscular

cattle by intramuscular inoculation while vesicular stomatitis can not be transmitted by this method. The means of inoculation is a factor also. Note that the horse is susceptible to vesicular stomatitis only, excepting that in some instances there is slight susceptibility to vesicular exanthema by inoculation on the tongue. Further note that vesicular exanthema affects swine only; a fact of general knowledge.

In setting up test groups incidental to outbreaks, animals often are inoculated as follows: Two pigs on the snouts, one horse on the tongue, one cow on the tongue and a second cow by intramuscular injection. If inoculation on the tongue of the horse and the cow and on the snouts of the pigs give positive results, vesicular stomatitis would be the diagnosis. If inoculations of such a group of test animals result only in takes on the snouts of the pigs, diagnosis of vesicular exanthema would be indicated; and if takes are obtained on the tongue of the cow, on the snouts of the pigs and by intramuscular injection in the cow with negative results in the horse, it would indicate that foot-and-mouth disease had occurred. It should be understood, however, that in making a diagnosis, clinical observations, history and all pertinent information with serological tests are used as are required and indicated by the circumstances.

The Bureau has 46 trained diagnosticians. They are so located at various points in the United States that it is possible for them to reach a point quickly where investigation and differential diagnosis may be made. Naturally, and as would be expected, these men are moved from time to time as required by other duties inasmuch as this is special work and only a limited amount of time is spent in such diagnostic procedures.

Understandings and arrangements exist between all the states and the federal authorities which provide for immediate action in the event vesicular or exotic diseases occur or are suspected. Primary investigations are made by state and federal veterinarians. If the findings of these primary investigations warrant, a diagnostician is called.

Veterinarians finding a suspicious disease, or having knowledge of one, should report it to their state veterinarian or to the disease control and eradication station in their state. Occasionally conditions not deserving such attention are reported. Such scare situations should be avoided. However, if any situation justifies it, do not hesitate to report your findings or information to the proper authorities.

When foot-and-mouth disease has occurred in the United States, it has been controlled by strict quarantine, patrolling, watchfulness for further spread, slaughter of infected and exposed animals (indemnities paid to owner), thorough cleaning and disinfecting, and the use of test animals on infected premises before they are restocked. These measures have been carried out jointly by the states and federal governments. The same measures have been applied to control and eradication of vesicular exanthema. Where it has been feasible, exposed and infected swine have been liquidated by slaughter at properly inspected meat plants on a salvage basis. Inasmuch as vesicular exanthema is not transmissible to man, it has been possible for the pork from such swine which passes meat inspection requirements to be used for human consumption after it has been processed by sufficient heat to assure that virus present has been killed.

As pointed out earlier, most outbreaks of vesicular exanthema occur through garbage feeding. It is, therefore, apparent that garbage must be cooked before it is fed to accomplish eradication. As all veterinarians realize, other benefits also will be obtained from cooking garbage.

Hogs fed garbage should be inspected at least semimonthly. Such inspection provides opportunity for detection of any outbreaks

which may occur. Also, inspection will go a long way toward coverage needed to establish effective cooking and to assure that premises are maintained in a sanitary condition. Of course the control of movement of swine which have been fed garbage is essential and is provided for specifically by federal regulations and by state regulations.

Worthy of note is the fact that most feeders report that cooking garbage is advantageous. Hogs so fed make greater gains, can be fed garbage at an earlier age and suffer fewer deaths than those fed raw garbage. Most feeders who feed cooked garbage say they would continue to cook it even if present requirements were lifted.

Research has been carried out in the United States on vesicular stomatitis and vesicular exanthema. All research on foot-and-mouth disease has been done elsewhere. At the United States Livestock Sanitary Association meeting held in Atlantic City, New Jersey in September 1953, Dr. M. S. Shahan, in charge, Plum Island Laboratory, made the following statement:

"Although some unexpected delays have been encountered in development of final plans for the Plum Island Animal Disease Laboratory, chiefly because of established high costs of island construction and other circumstances, plans are progressing with expectation that construction will be under way late in 1953 or early in 1954. While it is probable that construction of all facilities will not be accomplished before late 1955, it is expected that a limited program of related research may be initiated in advance of that time. It is the considered opinion of this Committee that the nation can not be judged as properly prepared for protection against foot-and-mouth disease and other dangerous exotic disease of livestock until this laboratory, properly staffed and equipped and adequately financed, is in full operation."

Studies conducted at Beltsville, Maryland, have revealed some useful facts about vesicular exanthema. It has been determined that any part of the carcass from swine infected with vesicular exanthema may contain virus. The viral agent has been found to remain alive after 30 days of carcass storage at normal meat cooler temperatures and after five months of storage at freezer temperatures. These facts have been demonstrated through experiments in which various parts of carcasses have been fed susceptible swine.

It also has been shown that all parts of the carcass may contain virus when the disease is in the incubation stage, even though the animal is not exhibiting symptoms or lesions. This conclusion confirmed earlier work by research authorities in California.

Further research at the Beltsville station is directed toward determining methods of infection by contact and by feeding; length of time the virus can remain infective away from animals, on such objects as pens, chutes, and other handling and transportation facilities, and the effect of heat and chemicals. So far it has been determined that virus can remain infective in pens and on facilities used for handling affected swine for as long as 72 hours. Virus types are being investigated to determine if more than one type is involved in existing outbreaks, and to find if the original virus has changed in strain or type as infection has spread. More than 500 swine have been used since the studies began in October 1952.

Observation during the last three years at the Pirbright England Research Institute show that unweaned white mice are satisfactory for use in studies of foot-and-mouth disease viruses. Infections of foot-and-mouth disease in white mice with a typical course have been obtained by using all of the six recognized types of foot-and-mouth disease virus. Thirty-five to 50 such mice may produce as much virus for vaccine, or other use, as one inoculated cow. The virus obtained from infection of white mice has been completely suitable for serological work as well as research and vaccine production activities. At the present time studies are under way to determine if white rats between birth and 36 hours of age also may be used.

Summary

The following summarization of the information and discussion presented in this paper is made:

1. Vigilance must be exercised continually toward detection of these diseases as they occur for the reason that the occurance of vesicular exanthema and the possibility of foot-and-mouth disease are ever-present threats.

2. Vesicular exanthema, vesicular stomatitis or any disease suspected of being vesicular exanthema, vesicular stomatitis, or foot-and-mouth disease must be handled by observing strict measures relating to spread.

3. All diseases suspected of being vesicular exanthema, vesicular stomatitis, or foot-and-mouth disease should be reported immediately to proper officials.

4. Vesicular diseases are indistinguishable

clinically and differential diagnostic measures are required to identify them.

5. Cooking garbage, inspection of swine fed on garbage, and the proper handling of swine and pork in transportation and trade channels are required to eradicate vesicular exanthema.

6. Research continues to establish new facts and to devise new means for doing research on these diseases and for handling the problems presented.

Also of possible interest in conclusion, the recognized disinfectants and method of preparation, as used in handling these diseases, is offered for your information:

1. A 2% lye solution (sodium hydroxide) is most effective. It is prepared by using one 13-oz. can of lye to 5 gal. of water. Where it is being used as a disinfecting agent, goggles, rubber gloves, and boots should be worn for protection.

2. A 4% soda ash solution (sodium carbonate) which is prepared dissolving 1 lb. of soda ash in 3 gal. of water is also used.

3. Sal-soda solution prepared by adding 13.5 oz. of sal-soda to 1 gal. of water is the third disinfectant in order of choice.

Acknowledgement is made to Drs. M. S. Shahan and F. J. Mulhern of the Bureau of Animal Industry's Washington staff for certain of the information presented in this paper.

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Raw meat scraps in garbage are said to be one of the hazards in the starting point for such virus diseases as vesicular exanthema, cholera, trichinosis, and foot-and-mouth disease in swine, and Newcastle disease in poultry. Certainly it is recognized that there are other means, especially direct and indirect contact of infected and susceptible hosts, of spread of these highly virulent conditions. Veterinarians are endlessly recommending sanitation, but raw garbage feeding must be given a just share of attention.

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Experience with human subjects seems to indicate that oral administration of terramycin alone, preliminary to intestinal operations, fails as an ideal intestinal antiseptic. There is some reduction in the coliform and other aerobes, but results are variable and uncertain so that resistant organisms, as well as Proteus, remain. In other words, as soon as one organism is controlled, other more resistant ones appear. The final conclusion is that results are deceptive, and that the prospect for complete control of fecal flora is not encouraging.

Animal Poisoning

(*Continued from page 140*)

2. Nitrazine paper.

Procedure.

1. Inject up to 5 ml. of suspected urine into a frog (dorsal lymph sac) or mouse. The urine should be slightly acidified to about pH 6.5. Nitrazine paper can be used to check the pH level.

2. If the urine is positive, characteristic strychnine convulsions should occur within a 45-minute time interval, usally in five to 15 minutes. The above two laboratory animals are recommended as indiscriminate use of various animals will cause misleading results, *i.e.*, doses of strychnine that will kill a man can be given to hens with no apparent ill effect.

It should again be emphasized that in certain of the foregoing tests, substances other than the one being tested for give positive reactions. However, these substances are rare, and seldom occur in livestock toxicology. Their main value lies in the elimination of certain toxic substances as the cause of death. In our toxicology laboratory, all positive reactions are confirmed by different methods and, in most instances, quantitative examinations are conducted.

TABLE I. Summary of Questionnaire Data

Livestock toxicology service established		7
Noncommittal		4
Did not honor questionnaire		6
Livestock toxicology service depends on cooperation offered by various state agencies		31
1. Need services of livestock toxicologist	14	
2. Feel that present service is sufficient	17	
Total		48

Summary

1. The results of a brief poll concerning the toxicological services available to the practicing veterinarian in the United States is discussed.

2. Presumptive diagnostic tests are presented for four different substances, *i.e.*, nitrates, HCN, arsenic, and strychnine. The feasibility of the practicing veterinarian being prepared to run such tests is discussed.

3. Symptoms as well as postmortem lesions are mentioned as aids to diagnosis.

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Because of the curl of his lips, the Samoyed frequently is called the smiling dog.—*Gaines Dog Research Center.*

Some Problems In The Laboratory Diagnosis And Control Of Leptospirosis†

MARTHA K. WARD,* Sc. D., Atlanta, Georgia

THE diseases of man and animals now known to be caused by microorganisms belonging to the genus Leptospira were first recognized in human medicine. The historical development of our knowledge of leptospiral infections has been recounted by Van Thiel, Joshua and Broom[1,2] and others and will not be discussed in detail here. It is interesting to note, however, that as early as 1891 the French physician, Sezany, suggested that Weil's disease was an infection primarily of animals which could be transmitted to man. During the 62 years since this suggestion first was made, no one has questioned it seriously; on the contrary, subsequently accumulated evidence has established firmly this hypothesis as fact.

Recent developments in the field of leptospirosis definitely indicate that these infections may be of considerable economic, as well as public health significance. Since infections in man may be considered to be accidental, and the human host represents a dead end for the parasite, it is obvious that one must consider the ecology of these diseases in the wild and domestic host if he is to have a thorough understanding of the host-parasite relationships, the epidemiology, the pathogenesis or the laboratory aspects of the leptospiroses.

The problems involved in the diagnosis and control of leptospiral infections in man and animals are not limited to the boundaries of any one professional discipline. Therefore, every effort must be made to define our most urgent problems in terms that clarify the role to be played by the veterinarian, the medical practitioner, the epidemiologist, the ecologist, the laboratorian, and other professional groups engaged in activities related to public health.

Since leptospiral infections are primarily zoonoses, the veterinarian has a responsibility of major importance not only in his own professional work but in the field of public health.

The author states that, "Leptospiroses are found whenever and wherever they are sought."

More and more cases of leptospirosis are found as both veterinary and medical clinician become aware of symptoms associated with infection. Furthermore, evidence is available suggesting a rate of inapparent infections much higher than previously considered probable.

The importance of this subject is not alone one of economics, as losses in infected herds are significant, but also because of transmissibility of infection to man through handling infected tissues or contact with urinary secretions.

It is becoming increasingly obvious that diagnosis of the leptospiroses on a clinical basis alone is difficult, if not impossible; therefore, the laboratory must assume a role of greater importance than sometimes falls to its lot in the case of many other diseases. Unfortunately, the procedures involved in laboratory diagnosis are troublesome, time consuming, expensive, and in many instances, lacking in standardization. They can be performed only in well equipped laboratories which are staffed with adequately trained personnel skilled in the specific technics. The past few years have seen an increasing interest in leptospiral infections and the inevitable result has been the swamping of the few available diagnostic facilities, unavoidable delays in processing specimens submitted for examination, and the impediment of much needed research in many fields of investigation related to these diseases.

Furthermore, the laboratory examinations which are being performed are meaningless unless intelligent interpretation of the results of these tests is made. No such interpretation can be assured unless there is a clear understanding of the limitations as well as the usefulness of the procedures involved.

When one attempts to define the problems facing the laboratory concerned with aiding the practitioner in the diagnosis of leptospirosis, he inevitably comes to the conclusion that the major and most serious one is the dearth of basic information available regarding the biology of the microorganisms themselves, and

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*Communicable Disease Center, Public Health Service, United States Department of Health, Education, and Welfare, Atlanta, Georgia.

the pathogenesis, the ecology, the epizootiology, and the epidemiology of the infections. Practically nothing is known of the fundamental mechanisms involved in the host-parasite relationship, which results in an apparently commensal association between the rodent and the organism on the one hand, and a true parasitism having potentially serious health and economic implications on the other. The effective filling of these gaping abysses in our knowledge can be accomplished only by intelligent collaboration between the man in the field and the man in the laboratory. Basic to this collaborative effort is an understanding by each of the other's problems.

Review

Let us review, briefly, the information available regarding the leptospiroses in the United States and the rest of North America. The first case of *Leptospira icterohemorrhagiae* infection recognized in the United States was in a laboratory worker and was described by Wadsworth and his coworkers in 1922[3]. The first case of infection with *L. canicola* in this country was reported by Meyer and his associates in 1938[4]. Klarenbeek and Schüffner had first demonstrated *L. canicola* infection in dogs in Germany in 1933[5].

Until about five years ago, it apparently was believed that in the United States, leptospiral infections were rare and were limited only to occasional cases of classical Weil's disease and canicola fever. Only 228 cases of human infection were recorded in the medical literature of the United States up to 1946[6].

Bovine leptospirosis was first recognized in Russia in 1935 and reported for the first time in the United States by Jungherr in 1944[7]. In 1946, Baker and Little isolated a filterable agent from cattle suffering from a febrile illness which was characterized by thickened, ropy, and bloody milk[8]; they later reported that the organism was a Leptospira[9]. This strain was demonstrated to be antigenically indistinguishable from *L. pomona*[10]. Serologic evidence for human infection with *L. pomona* was first demonstrated in this country by Beeson *et al.* in 1951[11]. Later in the same year an outbreak of human illness implicating this serotype of Leptospira was reported by Schaeffer[12]. Leptospiral infections in cattle now have been demonstrated in approximately 40 of the 48 states. During the past three years, we have obtained serologic evidence for more cases of human leptospirosis than had been reported in the United States through the year 1946. These infections have been distributed among individuals in 35 states.

Although the data essential for an accurate estimate of true prevalence of these infections are not available, it appears safe to assume that they are widespread in domestic animals, and perhaps also in the human population. The greatly increased number of confirmed cases of leptospirosis in recent years in this country, occurring concomitantly with the increased awareness of the protean nature of the clinical manifestations of the disease, has served to establish one fact: Leptospiroses are found whenever and wherever they are sought.

Furthermore, there now is evidence in North America of animal and/or human infections with *L. grippotyphosa, L. bataviae, L. ballum, L. autumnalis, L. hebdomadis, L. sejro,* and *L. pyrogenes.* Infections with these serotypes were unknown on this continent two years ago. A summary of types of leptospirae now known to be present in the United States and/or Canada, Puerto Rico, Cuba, and the British West Indies, indicating the animals in which the infections have been demonstrated, is given in table I.

Our knowledge of leptospiral infections in domestic animals is changing rapidly: (1) More and more cases of leptospirosis are being found, and available evidence indicates a probable high rate of inapparent infections among dogs, cattle, swine, and horses[13-15]; (2) it is now known that infections with one serotype of Leptospira are not necessarily limited to a single or even very few animal hosts as was previously thought to be the case, for instance, with *L. canicola. L. canicola* has been isolated from swine and serologic evidence has been obtained of infection with this serotype in cattle[16]; (3) conclusive evidence that leptospiral infections are at least one cause of periodic ophthalmia or "moon blindness' in horses has been demonstrated by serology, by isolation of the organisms from affected animals, and by experimental reproduction of the disease[17-19]; (4) the recently reported experimental transmission of Leptospira by certain species of ticks has provided evidence for the possible role of arthropod vectors in the transmission of these infections among both wild and domestic animals[20]; and (5) recent studies again have demonstrated and re-emphasized the highly variable clinical mainfestations of the disease as it occurs in animals, as well as in man, and the probability of multiple infections with several serotypes not only in a single herd, but also in a single animal[21-23].

These few enumerations will serve to call attention to the fact that old ideas are being constantly changed and modified. They also

emphasize that it is now realized, more fully than ever before, that there is much yet to be known about all phases of the leptospiroses, and that extreme caution must be exercised in interpreting the results of both field and laboratory studies.

It appears obvious that if the veterinary and medical practitioner or epidemiologist is to use the services of the laboratory most effectively, and is to interpret the results of serologic and bacteriologic work with assurance and intelligence, he must understand thoroughly the principles, and especially the limitations, of the technics and procedures we use.

Laboratory Diagnosis

Without going into technical details, we shall try to indicate some of the problems involved in the laboratory diagnosis of leptospirosis.

In these infections, as in many others, two general methods of approach are available: The direct methods, including isolation of the organisms and/or its demonstration in appropriately stained sections of tissue; and the indirect methods for demonstration of antibodies produced as a result of infection.

1. *Direct methods.* The isolation of leptospirae is too infrequently accomplished although the actual procedures involved are not prohibitively difficult. The importance of isolation attempts can not be emphasized too greatly, especially if one is to say, with any certainty, exactly what serotype is involved in a particular infection. This information may be of considerable epidemiologic and clinical importance, and it can not be obtained without studies of the organism itself. This is true mainly because of the rather close serologic relationship of certain serotypes of Leptospira and the resulting paradoxical situation which is being recognized with increasing frequency; *i.e.*, the more rapid initial rise and higher titer to a heterologous strain than is observed with the homologous antigen early in the disease. These heterologous titers may

TABLE I. Leptospirae Known To Be Present In North America[1,2]

Serologic Group	Known Hosts	Known Mode of Transmission to Man
1 *L. icterohemorrhagiae*	Rats Mice Dogs Mongooses Swine[**3]	Contact with infected animals Contaminated food and water Working in contaminated areas
2 *L. canicola*	Dogs Sheep[3] Swine Cattle[3] Horse[3]	Contact with infected animals Contaminated water (Outbreak in group of swimmers)
3 *L. pomona*	Cattle Swine Horse Mule[3]	Contact with infected animals Contaminated water (Outbreak in group of swimmers)
4 *L. bataviae*	Rats Mice Mongooses	Contaminated water
5 *L. autumnalis* (Proved agent of Fort Bragg Fever)	Unknown	Unknown
6 *L. ballum*	Rats Mice	Contaminated water
7 *L. pyrogenes*	Rats Mice	Contaminated water
8 *L. hebdomadis*	Mice	Contaminated water
9 *L. grippotyphosa*	Cattle[3]	Unknown
10 *L. sejro*	Cattle[3]	Not yet recognized in man in North America

1=Data compiled from several sources.
2=In United States and/or Canada, Puerto Rico, Cuba, and British West Indies.
3=Serologic evidence. No isolates.

persist at a higher level than the homologous titer for surprisingly long periods of time. This fact is well illustrated in the case of the one accidental infection that has occurred in our laboratory. *L. icterohemorrhagiae* was isolated from the patient's blood by direct culture, but a higher antibody titer to *L. canicola* was demonstrated in serum specimens collected over a period of several months. A summary of this data is given in table II.

Furthermore, if, as has been done in the past, one is to attempt to correlate certain specific symptomatology or variations in severity of infections with the specific serotype of the infecting strain, it is essential that the antigenic structure of the infecting strain be established beyond any reasonable doubt. Although, from a biologic point of view, one would suspect that any serotype of Leptospira could be responsible for the whole gamut of clinical variations from inapparent infection to mild, moderate, severe and even fatal illness in man or other animals, it has been observed that some serotypes appear to be associated more frequently with mild clinical illness, some with extremely serious disease, and others with a clinical picture of intermediate severity[24]. It may be of interest to establish such a possibility as an indication of the probable prognosis of a particular illness. The assembling of this data is dependent upon accurate clinical observations, which the practitioner must make, and the accurate identity of the etiologic agent by the laboratory.

Appropriate timing, selection, and proper handling of specimens are essential to successful isolation attempts. Specific directions for collection and shipment of all specimens should be obtained from the laboratory involved before any materials are submitted for examination. The organisms usually are found in the peripheral blood and probably in the cerebrospinal fluid, from the first or second day after appearance of symptoms through the seventh to tenth days,[1, 24, 29] and frequently may be isolated by direct culture in appropriate medium if precautions to eliminate bacterial contamination and to assure other favorable conditions for growth of the organisms are followed. After about the tenth day of illness, organisms usually disappear from the blood stream and establish themselves in the kidney[1]. They are excreted in the urine for variable periods (and in many cases intermittently), depending probably upon several factors, the most important of which appear to be the species of animal involved and kind of therapy administered. Since it is almost impossible to obtain urine specimens completely free of bacterial contaminants, thus making direct cultural attempts impractical, one must resort to animal inoculation methods for examination of urine. The weanling hamster appears to be the laboratory animal of choice at present, though recent work indicates that the day-old chick may be used successfully[26]. Details of cultural and animal inoculation procedures used by the Army Medical School group may be found in the April 1953 issue of the *American Journal of Public Health*[27]. The procedures employed in our laboratory are essentially the same and are described in a paper now being prepared for publication[18]. Sections of kidney or liver tissue taken at autopsy and stained by an appropriate method (*e.g.* Levaditi's) may, on occasion, give valuable information regarding the possible etiology of a fatal disease. However, these must be prepared and examined by trained and experienced individuals to prevent confusion resulting from artifacts, which sometimes closely resemble leptospirae morphologically. It must be remembered, also, that no information regarding serotype of Leptospira involved can be obtained by morphologic studies, and the possibilities of artifacts must be considered.

TABLE II. Heterologous Antibody Rise in Leptospiral Infection* Patient: M.B. Mc.

Day of illness	Titer *vs. L. icterohemorrhagiae*	Titer *vs. L. canicola*
2	0	0
13	1024	64000
28	1024	8000
51	1024	1024
72	1024	512

Blood culture positive for *L. icterohemorrhagiae* A.

*Microscopic agglutination test.

Direct, dark field examination of blood and urine results so frequently in misdiagnosis that it is not to be recommended as a single diagnostic procedure. Usually, so few spirochetes per unit volume are present in the blood that they are missed, and more seriously, "pseudospirochetes" (protoplasmic extrusions from blood cells, platelets or of other origin) confuse even the experienced worker and lead to a false positive diagnosis[1, 29]. On occasion, organisms with characteristic morphology and motility are present in a freshly voided sample of urine in sufficient numbers to be recognized readily. However, confirmation by isolation always should be made since the same possible

confusion by pseudospirochetes is a hazard, and the organisms rapidly lose their motility and characteristic morphology at the acid pH of urine. I should like to repeat that it is the opinion of practically every worker in the field that direct, dark field examination never should be used as a single diagnostic procedure.

2. *Serologic methods.* The most generally used procedures, and those against which newly developed ones must be evaluated, are the microscopic agglutination and agglutination-lysis tests[29,30]. These two differ only in the formalinized or living state, respectively, of the antigens employed. Unfortunately, in using the two methods, there have been discrepancies in results of tests performed on the same sera in the same laboratory as well as in two different laboratories. However, either test is remarkably reproducible if it is performed under carefully controlled and standarized conditions by adequately trained and experienced personnel. But unless the identity of the antigen strains is clearly defined and such factors as age of culture, density, hydrogen ion and electrolyte concentration are controlled and standarized with care, the results of tests in a single laboratory may vary significantly from one day to the next. It has long been our opinion that one or a combination of these physical, chemical and human factors is largely responsible for reported discrepancies between laboratories using living and formalinized antigen. A recent study made by the Communicable Disease Center Laboratory in collaboration with the Veterinary Division of the Army Medical Service School[18] definitely proves that, in so far as these two laboratories are concerned, there is no difference in the results obtained by the two methods in the examination of human sera. There is indication that at least some bovine sera affect the two antigens differently, but serum from this same species also gives results difficult to interpret in other serologic tests for leptospirosis. Consequently, the factor or factors involved are most likely related to the species of animal rather than the technics involved in the performance of the tests.

Recently developed antigens for the complement fixation test offer the possibility of a rapid screening method for determining the presence or absence of leptospiral antibody in current or recent infections. However, any complement fixation test has certain inherent difficulties, and in the case of leptospirosis, complement fixing antibody detectable by present methods apparently disappears from the blood stream more rapidly than does agglutinating antibody. Whether or not this is true of all animal species or whether it will remain true as other antigens for complement fixation tests are developed can not be predicted. However, until further information on this point is available, it appears that complement fixation tests are useful only as a method for diagnosis of current illness. In the light of our present knowledge they may not be used with impunity for survey or prevalence measurements.

The capillary tube agglutination test[21] and the even more recently developed macroscopic agglutination test[22] offer promise of a simpler, less time-consuming method for leptospiral serology. To date, these two tests have not been used in our laboratory in a sufficient number of instances for us to comment further. The macroscopic reading in both instances is a decided advantage.

Regardless of what serologic method is used, certain fundamental facts must be kept in mind:

1. At least two properly timed specimens—one taken early in disease and one taken two or three weeks later—must be examined and a significant rise in titer (at least fourfold in a twofold dilution scheme) must be demonstrated for diagnosis of current infection. The inapparent infection rate in animals is most probably high, so that a positive titer in a single specimen may indicate only past experience with the organism and may have nothing to do with the current illness. Again, specific information regarding collection and handling of sera for examination should be obtained from the laboratory before specimens are submitted.

2. It must be remembered that determination of specific serotype can not be made on the basis of serology alone. Isolates must be obtained and studied before definitive identification of the specific strain of Leptospira involved can be made.

3. Very little is known about cross-reactions in serum of individuals having other diseases that give a clinical syndrome similar to any one of the numerous manifestations of leptospiral infections. Even less is known about nonspecific rises in titer of an anamnestic nature.

4. Careful differential clinical diagnosis always should be attempted, adequate histories should be taken, and results of laboratory tests interpreted in the light of this information.

Some comment should be made regarding the problems of prophylaxis and the control of leptospiral infections. The only available methods which approach any degree of satisfaction at present are the practice of good sanitary and animal husbandry methods, to prevent spread of organisms within a herd of animals, and

the use of certain antibiotics to eliminate the carrier state. Basic to the establishment of successful practices of control by sanitation methods is recognition of the fact that an animal recovering from disease, or one with an inapparent infection, may shed the organisms in its urine for a long period of time—perhaps for three to six months or more. We still do not know the exact duration of leptospiruria in various species, nor do we know all of the factors affecting the survival of the organisms in contaminated environments. The problem of isolation of infected animals for long periods and adequate decontamination of feed lots, pastures, *et cetera* is a considerable one.

The use of antibiotics to eliminate the carrier state appears to deserve further investigation since it has been demonstrated that streptomycin, aureomycin, and perhaps others, in adequate dosage, will relieve some animal species of leptospiruria. It should be mentioned here that some antibiotics, for example penicillin, may change the course of clinical illness but may fail to prevent excretion of the organisms in the urine of the treated individual.

The production and commercial availability of an effective vaccine for leptospirosis, is, of course, highly desirable. The characteristics most usually sought in a vaccine are: (1) High antigenic potency, (2) broadness of antigenic spectrum, (3) demonstrated effectiveness in prevention of infection in the immunized animal, and (4) safety in at least two respects: (a) Proof that the vaccine will not cause infection if an attenuated, living organism is used, and (b) proof that it will not cause other deleterious effects in the vaccinated individual.

In the case of leptospirosis, two of these points especially should be emphasized. We now know that many animals, for example cattle, may be infected with any one of several different serotypes of leptospirae. The available evidence definitely indicates that there is little or no cross protection between even closely related strains. Consequently, to be effective a vaccine should be prepared from all strains known to infect the particular animal species one wishes to protect, or perhaps from some, as yet unknown, antigenic fraction of Leptospira organisms common to the entire genus.

An even more important consideration is the fact that urinary carriers are perhaps the greatest potential hazard in the spread of infection among a herd or from animal to man. Animals with inapparent infections, or those which have recovered from clinical illness, may excrete leptospirae in their urine for long periods of time. If one is to control leptospirosis by vaccination, it must be demonstrated beyond any reasonable doubt that the vaccinated animal will not become a urinary carrier after exposure to infection even though no signs of illness are apparent. The work of Brunner and Meyer[13] emphasizes this point. These workers reported that one of seven dogs vaccinated with their preparation became a carrier after the challenge dose, despite demonstrable antibody and no signs of clinical illness. Regardless of how good a vaccine may be in other respects, until it has been demonstrated, in adequate field trials, that the preparation prevents inapparent infection and establishment of the carrier state, the problem of control of these infections has not been solved.

Since the leptospiroses are most probably of considerable economic and public health significance for both man and animals, the veterinary practitioner has an unusually great responsibility to demand and carefully examine the pertinent facts before he uses, or refuses to use, any vaccine or other product as a control or therapeutic measure.

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(*Continued on page 170*)

Some Practical Suggestions For The Control Of Swine Diseases†

J. L. KIXMILLER,* D.V.M., Indianapolis, Indiana

DISEASE of swine can not of course be controlled effectively by the owner alone, even though he may have excellent facilities and provide proper feed to maintain good health.

Nor can the veterinary practitioner keep a herd healthy, even though he is qualified to diagnose, prevent, and treat diseases, and has state and federal laws to help him control the spread of diseases, and can obtain laboratory assistance for help in diagnosis.

Given intelligent cooperation by swine owners, however, the veterinarian can prevent the spread of many diseases and prevent losses if he actively solicits cooperation from the swine grower. That means, among other things, passing on practical suggestions as to what the owner can do to prevent spread of certain disease conditions. Such suggestions, with reminders about veterinary services, are the subjects of this brief discussion.

Management of the Sow and Pigs

The basic need for strong, healthy breeding stock that is free from disease and parasites must be emphasized. Some swine raisers need to be reminded that nutrition must be proper and adequate; that sows, while in gestation, should have plenty of exercise as well as an adequate supply of animal protein and minerals, plus a good grain ration; that at farrowing time sows should be free of lice and be housed in clean, dry quarters.

Sows need little nourishment for 24 hours before and 24 hours following farrowing, but they should have plenty of water to drink. Some owners allow a light laxative diet, which probably does no harm if the animal indicates hunger, but even this should be fed sparingly. When a laxative is deemed necessary, a light grade of mineral oil may be poured on the drinking water, and if a more drastic purge is considered advisable after farrowing, lentin is recommended.

Suggestions as simple as these often can prevent mastitis, referred to by owners as "milk fever." If, however, mastitis does develop, lentin is recommended followed, after about 20 or 30 minutes, with an injection of posterior pituitary extract. Withhold feed until the sow wants to eat, then allow only a laxative line of feed for two days.

Always remind the owner that the sow and her pigs should not be confined in closed quarters longer than two weeks. Pigs need to get out on grass and soil for exercise and sunshine. Both sows and pigs need to be provided adequate amounts of animal protein and minerals until pigs reach the weight of 125 lb. After reaching this weight, they will progress without it and finish out satisfactorily. With a good start in early life, pigs will be more resistant to certain diseases.

During the winter months when pigs are housed for lengthy periods, they should be allowed sod that has had iron sulfate, copper sulfate, and slaked lime dusted over it. If that is not convenient or satisfactory, furnish the owner antianemia preparations he can give as prescribed.

Normally healthy pigs can be castrated at four weeks, wormed and treated for lice at five weeks, and immunized against hog cholera when six weeks of age. It never is advisable to attempt immunization and weaning of pigs simultaneously.

When a veterinarian makes arrangements for vaccination, it is good practice to ask that they be confined to comfortable pens overnight, and allowed drinking water only. Upon arrival throw in a little shelled corn and observe reaction. This should be done, incidentally, without getting into the pen, as your purpose is to observe animals under normal conditions. If not startled while being fed the corn, pigs will be active and hungry. At this point, those not interested in eating, should be marked for identification. Often, this examination and temperature readings will indicate subclinical diseases. The time spent in careful observation

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*Field Service Staff, Allied Laboratories.

may prevent repeat calls or postvaccination disturbances. The veterinarian who follows this plan before vaccinating a herd not only will impress the owner with his carefulness, but it also will give him an opportunity to see what is "behind the syringe."

Personally, I find that pigs fed on a lighter diet for 14 days following vaccination usually do much better. It may be that they do exhibit less reaction to vaccination because of less high protein feed stimulation. One veterinarian expressed the matter to a client as follows: "The average automobile battery will give you a better light when the starter is not used at the same time."

All are aware that vaccination of swine against hog cholera has changed in the past few years. Instead of killed virus vaccines and serum and virus, several modified live virus vaccines have been made available. Some of these must be used with serum, others alone. Vaccines produced by serial passages through rabbits are continuing to gain popularity because it is possible to use them with or without hog cholera antiserum and still produce dependable and lasting immunity.

Familiarity with past experiences in the herd make possible intelligent planning for the safest and most economical vaccination procedure. If it is desirable to have immediate protection, or if it is considered advisable to use simultaneous serum, it may be used and still produce satisfactory immunity. One fact always should be kept in mind, that no matter what vaccine is used, pigs must be thrifty, healthy, and reasonably free from parasites to acquire a good immunity. This is a point on which insufficient emphasis has been placed.

Frequent Concurrent Infections

Swine flu, erysipelas, hemorrhagic septicemia and salmonellosis in acute form are diseases most easily confused with hog cholera. All respond to treatment during early stages, but before treating any of these conditions, pigs must be protected against hog cholera.

Flu in swine usually affects several of the herd suddenly. When treated promptly, satisfactory response is obtained. Sick animals should be isolated and placed in clean, sanitary surroundings, free from drafts. Sprinkle bedding and floor with a guaiacol solution, or kerosene containing two ounces of pine oil per gallon. Also, use guaiacol in the drinking water. Injectable sulfonamides are used frequently with good results, as comphorated oil etherial with guaiacol. Pigs which do not develop pneumonia, usually recover from swine flu in a few days.

Acute erysipelas may show up in swine suddenly, in fact, one or two may die before the owner realizes any are sick. They exhibit soreness, and movement is stiff. Eyes are alert generally, which is a sign that helps rule out suspicion of cholera.

Using swine erysipelas antiserum in the acute form of this disease will save 90% of those affected. Thus, it is not only possible to confirm diagnosis, but death losses may be prevented. Arthritic and chronic types of the disease do not respond well to treatment with the serum. In 26 states, the erysipelas antiserum and culture are now used on young pigs with satisfactory results. In the interests of the swine industry in the 22 states where the serum and culture method can not be used, researchers have been investigating the value of killed-culture bacterins. Bacterins have been used successfully in Europe for a number of years. Our research group has made good progress in this work, and it is hoped that the killed-culture bacterin soon will be available to the veterinary profession. One fact to remember is that man can contract some painful infection by careless handling of the culture and infected tissues.

Hemorrhagic septicemia, due to the Pasteurella organism, is a swine disease that can cause much trouble, especially in its acute septicemic form. When it is complicated with *Salmonella cholerasuis* organisms, cholera may be suspected, especially if the herd is susceptible. Diagnosis is aided often, however, by temperature readings. In hemorrhagic septicemia, temperatures are more variable than in hog cholera. They sometimes reach 107 F. Most often, one will find pneumonic conditions present, but symptoms of the intestinal form may predominate.

Strict adherence to isolation and sanitation practices is advisable. Use antiserum on sick animals and no. 1 mixed bacterin on those which are well, following label instructions. Some practitioners use injectable sulfonamides intraperitoneally, in combination with bacterin. Instruct owners to feed a light diet such as oats or buttermilk, and medicate drinking water with guaiacol or sodium sulfathiazole.

Salmonella cholerasuis or Suipestifer is the disease formerly thought to be hog cholera. Even now it is sometimes confused. It is often observed as concurrent infection with hemorrhagic septicemia, and in the septicemic form it may cause death in less than 24 hours. At first, the animals do not ap-

pear to be seriously ill. I have seen temperatures up to 108 F., and wondered what the condition could be, until laboratory cultures revealed nothing but Salmonella.

I will never forget the first case of the septicemic form of Salmonella in my experience. A herd of marketable hogs, with extremely high temperatures did not appear to be ill. They looked at corn, and even ate a few grains, had a clear eye, then lay on their sides and squealed before dying as though they were in distress. After death, some bluish discoloration was found in the white skin. At autopsy, hemaglobin was noted to be 30% on the Talquist scale. Petechial hemorrhages were observed throughout the pleural and viseral cavities. The liver was firm; spleen enormous in size, dark, and soft. Laboratory specimens revealed pure cultures of Salmonella in every tissue.

Fortunately, Salmonella is not usually septicemic in nature, and can be controlled by isolation of sick animals, and by placing them on a diet of oats soaked in medicated solution, or, buttermilk and salt may be used. The Salmonella bacterin (100%) should be used as recommended on the well pigs of the herd, since it may prevent later outbreaks.

Necrotic enteritis in pigs often will show some Salmonella infection but this organism is not always found in the chronic type of enteritis. It often is present in old barnyard infections, and (in the chronic type) may be confused with nutritional troubles.

Burcellosis in swine, currently causing much concern, is a disease that must be eliminated by blood testing animals on the farm, as well as those which are purchased. Owners should be reminded that both man and cattle are susceptible to swine brucellosis.

Atrophic rhinitis now is recognized as a serious disease among swine. It usually is not discovered by swine raisers until several pigs develop crooked snouts. If others in the herd commence sneezing, the veterinarian immediately becomes suspicious, and should alert the owner. Atopsy finding in pigs with crooked noses almost always will reveal destruction of turbinate bones.

Gut edema, or edema disease, is a condition found most often in the midwestern United States. It also is recognized in Canada.

One sees swollen eyelids, incoordination, and staggering gait. Temperatures do run high, and are variable. Not all pigs autopsied reveal edema, which commonly is observed along the greater curvature of the stomach, but may be found in any part of the viscera, or according to some observers, in any part of the carcass.

Saline solutions have been found to be beneficial in gut edema. They are added to a thin diet, or to drinking water. I prefer to leave the drinking water without medication, so that the pig can, and will, drink adequate amounts of it. Buttermilk, with salt added, and oats soaked in an alkaline, medicated water are satisfactory. The important thing is to practice isolation, sanitation, and light feeding, with the addition of saline solutions.

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Bat Rabies in Florida

(*Continued from page 135*)

that it extends into the vampire bat area, and may become infected through the bite of vampire bats. Pawan[2] reported the occurrence of rabies in fruit-eating bats, with vampire bats as the probable source.

At present it is a matter of conjecture whether these observations represent a localized situation or a widespread yet unrecognized one. The limited information available simply raises further questions as to the possible source and mode of transmission of rabies infection in the insect feeding, free-living bats and to the part they might play in the overall rabies picture in other mammals. Extensive studies will be necessary to answer some of these questions.

Since 1951, there has been an increase in sporadic, unexplained cases of rabies in wildlife in Florida, particularly in raccoons as shown in table 2 and 3. Certainly the discovery of this new host only complicates the already difficult control measures in wildlife rabies.

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Department of Agriculture scientists report (*Agri. Res.*, February 1954) that sufficient quantities of saponin from alfalfa were recovered to test this substance suspected to be the cause of bloat in cattle and sheep. They report that in eight of ten tests, administration caused rumen distention severe enough in at least one case (sheep given 55 mg.) to require emergency lifesaving treatment.

PRINCIPLES OF ANIMAL HEALTH

R. R. DYKSTRA, D.V.M.
Manhattan, Kansas

Immunity Through Colostrum

Colts from dams that, during the later stages of pregnancy, have been immunized against tetanus also will be immune through the dam's colostrum, and to a lesser extent, by way of the placenta. When the colt is six weeks of age, it should be given additional protection by the injection of a mature animal dose of alum precipitated tetanus anatoxin, and this latter is to be repeated at one year of age. This recommendation is from the 1953 Proceedings of the International Veterinary Congress. In the United States, along similar lines regarding hog cholera immunization, research workers demonstrated many years ago that pigs from cholera-immune sows, if inoculated within the first three days of life with 2 to 3 cc. of virus, acquired a permanent immunity, and that this immunity could be produced in each succeeding generation of pigs by the inoculation with comparable doses of virus given within the first three days of extrauterine life.

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Hydatidosis in South America

During a South American trip in 1952, we learned that veterinarians on the continent quite generally are resorting to the use of arecoline hydrobromide in treating canine patients to eliminate echinococcal infestation. The recommended oral dose is 4 mg. for each lb. of animal weight. Usually the arecoline is made up in a 1% aqueous solution to which a small quantity of sugar is added for palatability. In some areas there is also a program of stray dog elimination, and attempts are being made to keep therapeutically treated dogs from having access to cystic offal to prevent reinfestation. Since wolves, foxes, and other Canidae harbor *Echinococcus granulosus*, this raises another problem in the handling of hydatidosis.

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One aspect of vesicular exanthema outbreaks in swine is that it is a serious problem to distinguish it clinically from foot-and-mouth disease. Laboratory and inoculation tests are necessary for differential diagnosis of the two ailments.

In certain countries in which bovine tuberculosis remains a problem, and when time for eradication of the disease has not been developed, B.C.G. (Bacillus Calmette—Guerin) vaccination is a temporary expedient. Calves known to be free from tuberculosis are vaccinated as soon after birth as possible by subcutaneous inoculation of 50 to 100 mg. of moist culture in the region of the dewlap. Intravenous inoculation is sometimes practiced, although this may cause systemic reaction. Vaccinated animals must not be exposed to contamination from heavily infected sources. Vaccinated individuals react for approximately one year to a tuberculin test. Severe, unsightly swellings are sometimes observed following subcutaneous inoculation. There is no field for this form of tuberculosis control in the United States.

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A dairy operator told us a short time ago that for fly control on his cattle he was using satisfactorily an apparatus by means of which the animals spray themselves with an insecticide and thus relieve the owner of an otherwise time-consuming, arduous task. The apparatus is placed in a doorway or in an opening between the corral and the lot in which the drinking troughs are kept. In going through the apparatus, the cow steps on a treadle which energizes the pump so as to cover the animal with a fine spray. The spray used was a combination of lindane and pyrethrum.

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From the *Journal of the American Medical Association* we learn that, in the treatment of localized actinomycosis in man, better results have been obtained from oral administration of isoniazid (nydrazid) than following use of certain sulfonamids and antibiotics. We doubt the significance of this in the handling of this mycotic condition in animals because, from the standpoint of medication, the intravenous use of a solution of sodium iodine has given splendid results, as has surgery in operable areas. Certainly the disfiguration sometimes occasioned by extensive surgery of the mandibulofacial region is of minor import in animals.

The Diagnosis Of Ringworm In Animals†

LUCILLE K. GEORG*, Ph. D., Atlanta, Georgia

THE Mycology Laboratory of the Communicable Disease Center has become concerned with the problem of ringworm in animals for the following reasons: First, the presence of ringworm in such animals as dogs, cows, horses, and domesticated rabbits is a constant source of infection for persons who have pets or who live in rural areas where they come in contact with farm animals; second, a knowledge of the extent of ringworm in animals, as well as the species of pathogenic fungi involved, is important in epidemiological studies concerning the problem of ringworm in both man and animals; and third, accurate diagnosis of ringworm in animals is of value in improving and developing methods for the treatment and control of this disease.

Aside from ringworm of the feet, the so-called "athlete's foot," and infections of the groin areas and of the trunk, which are common forms of ringworm in man, there are several types of human ringworm infections which usually are found only on the exposed parts of the body: The scalp, face, neck, arms, hands, and legs. Ringworm in these areas may be divided into two classifications: (1) Ringworm of the "human type," caused by fungi which are passed directly or indirectly from man to man, and which, except for a few reports, never have been found to infect lower animals; and (2) ringworm of the "animal type," caused by pathogens which commonly attack lower animals and occasionally infect human beings.

Urban Ringworm

As might be expected, the human type ringworm is of major importance in our towns and cities, and large scale epidemics due to such fungi as *Microsporum audouini* and *Trichophyton tonsurans* have become important public health problems[22,48]. *M. audouni* ringworm occurs largely in children, and infections are readily transmitted directly from child to child, or they may be transmitted indirectly by infected hairs that adhere to caps, upholstery, and other such media. Epidemics involve many hundreds of school children yearly in all sections of the United States. There are three reports in the literature of infection of a lower animal by this fungus, one in a monkey,[42] and two in dogs[28,40]. In spite of these few reports, however, it is possible that lower animals may play an unsuspected role in the spread of this parasite.

T. tonsurans ringworm occurs in both children and adults and has reached epidemic proportions particularly in the southwestern states. There is no clear record in the literature of this fungus causing disease in lower animals.

In spite of the prevalence of these epidemic types of ringworm, about 10 to 30% of the ringworm in urban areas is infection contracted directly or indirectly from animals[29,44]. Pet cats and dogs are the major source of these infections, and *Microsporum canis* is the fungus usually involved. Although children are more susceptible than adults, infections

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*Communicable Disease Center, Public Health Service, U. S. Department of Health, Education, and Welfare, Atlanta.

occasionally occur in the adult. In adults, lesions usually are found on the smooth skin, but in children the fungus frequently infects the scalp where it produces raised, boggy, suppurative lesions called kerions. The presence of such kerion-type lesions does, in fact, suggest to the physician or dermatologist that there has been an animal source for the infection since the human type ringworm species rarely produces a suppurative reaction of this type. *M. canis* infections acquired from animal sources may subsequently be passed to close human contacts such as other members of the family and, occasionally, to neighbors, thus causing small-scale epidemics. One recent report[41] gives evidence of the transmission of *M. canis* by a kitten to eight human contacts and three canine contacts. In general, large-scale epidemics in man do not stem from ringworm cases contracted from animals, but many isolated or group infections may occur in a community where large numbers of cats and dogs are infected with ringworm. Such a situation apparently has been present during the past several years in some sections of Great Britain, and the British public health authorities recently have instituted campaigns to track down each human case to the animal source, and to enforce treatment or disposal of the animal reservoirs[87].

M. canis infections are easy to detect in both man and animals. This is due to the fact that hairs infected by Mycrosporum species usually fluoresce brightly under a Wood's lamp when examined in a darkened room. In some cases, however, particularly in *M. canis* infection of the cat, there are no obvious lesions. Often all that is observed are a few scattered areas of alopecia over the bridge of the nose or loss of hair along the edges of the ears. But when the animal is taken into a darkened room and carefully examined by means of a Wood's light, a scattering of brightly fluorescent hairs can be seen [14,56]. The lesions in dogs usually are more evident, and appear as clearly circumscribed areas covered with scales and stubs of broken hairs, or appear to be free of scales and completely depilated[56]. However, inapparent infections may occur in both cats and dogs and their detection is important in the control of this disease in animals and its transmission to man [54,81].

Rural Ringworm

In rural areas, human type epidemic ringworm is less of a problem than in cities. Here population is widely scattered and the number of human contacts are few. On the other hand, rural ringworm, probably because of the increased opportunity for animal contacts, is largely of the animal type, that is, it is largely contracted from infected animals.

In addition to dogs and cats, which indeed are an important source of human ringworm infections both in the city and in the country, there are a number of other animals which transmit ringworm to man. These are the many domesticated animals found on farms: Cows, horses, donkeys, sheep, goats,[2,7,15,20,21,24,33,38] rabbits,[45] guinea pigs,[26] and chickens, [4,29,59] also wild animals, including mice,[9,12,27] squirrels,[16] muskrats,[10,17,8] and animals such as foxes[6] and chinchillas[6] that are raised in fur-breeding ranches. Horses on breeding farms, in army stables, and at race tracks also constitute a source of human ringworm infections[1,3,5,8,10,30,84,85].

While only 10 to 20% of human ringworm in the urban areas is of animal origin, often 70 to 80% of human ringworm infections in the rural areas is of animal origin; and while *M. canis* is the common animal type pathogen found in the cities, *Trichophyton verrucosum* and *Trichophyton mentagrophytes*, the usual etiologic agents of ringworm in cattle and horses, are the common animal type pathogens seen in rural areas.

Human infections due to these latter organisms differ from human Microsporum infections in two important respects. In the first place, adults appear to be as susceptible as children. Cases of ringworm of the face, neck, and arms are seen rather commonly in adult farm workers who have contacted ringworm-infected animals. The infections may be transmitted secondarily to other adults or to children in the family or the neighborhood, but like *M. canis* infections, do not become epidemic. Secondly, Trichophyton infections are more difficult to diagnose in both the human and the animal because Trichophyton-infected hairs do not fluoresce under the Wood's lamp.

All of the animal type infections in man have one characteristic in common. This is the development of suppurative lesions, particularly when infections occur on the bearded area of the face or on the scalp. Such suppurative ringworm lesions are seen commonly in the farm population of this country, particularly in the northern states where Trichophyton infections are common in cattle and other farm animals. The patient may have considerable discomfort, itching, pain, and fever. Individuals with severe lesions may be incapacitated for several weeks . The discom-

fort, temporary incapacitation, and economic loss involved makes this type of ringworm an important public health problem.

Ringworm of animals not only merits study and control because of its importance as a source of human infections, but also because of its significance as a disease of the animals themselves. Although, in general, lesions in animals are of rather superficial character with little tissue reaction other than scaling and loss of hair, in some animals, infections may become extensive and severe.

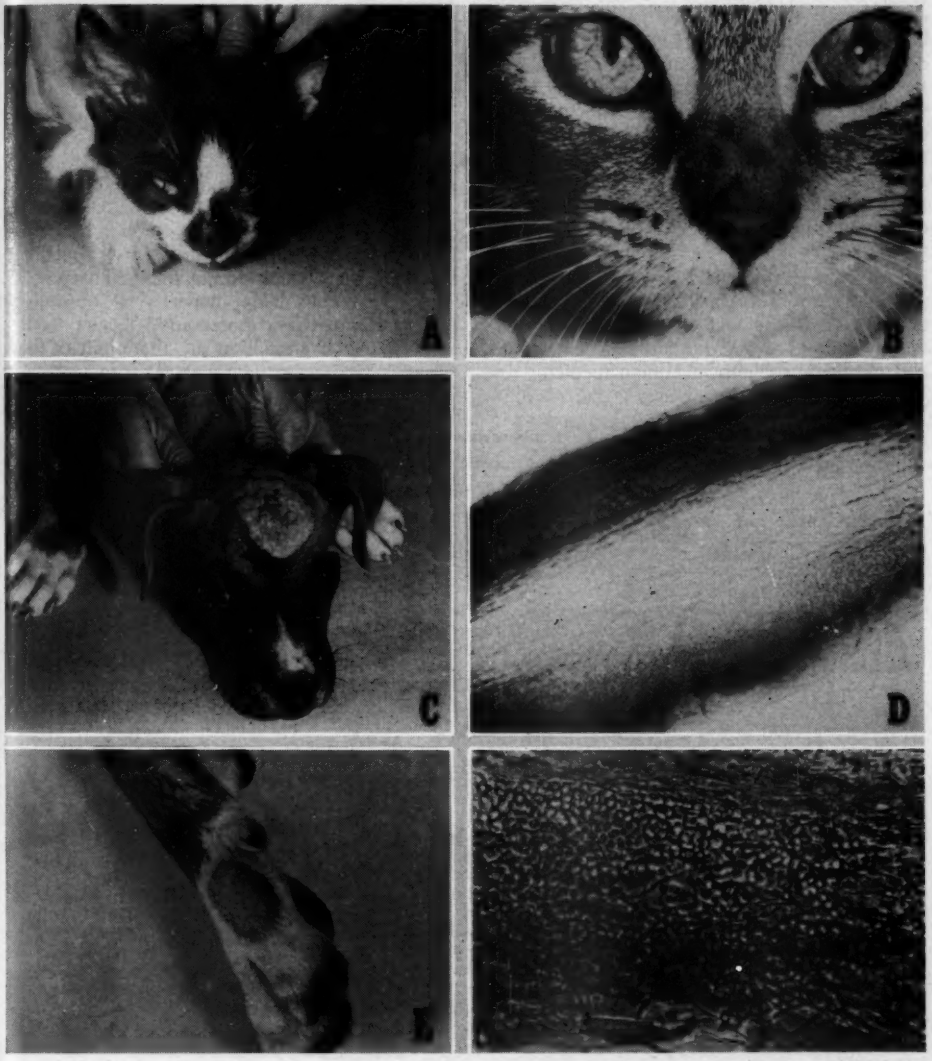

Fig. 1. (A) Microsporum canis infection in a kitten. Loss of hair on nose and edges of ears, and generalized scaling were the only visible signs of disease.
(B) Microsporum canis infection in an adult cat. Areas of hair loss on nose (dark spots) were the only visible signs of disease.
(C) Microsporum canis infection in a dog. Clearly defined areas of alopecia and scaling are seen on top of the head and on the right upper lip.
(D) Hair infected by Microsporum canis. Shows sheath of small spores in mosaic.
(E) Microsporum gypseum infection in a dog. Solitary lesion on the foot shows a clearly defined area of scaling and hair loss.
(F) Hair infected by Microsporum gypseum. Shows mass of large, irregularly shaped spores covering surface of a hair.

When animals are kept together in large groups or in close quarters, infection spreads rapidly. In cattle, 50 to 60% of a herd may be infected. In cavalry units and race track stables, infections are carried easily from animal to animal not only by direct contact, but indirectly by brushes, harnesses, and other equipment. Epidemics this past year among horses at Atlantic Coast race tracks gave evidence for the need of better control of ringworm. In the fur breeding industries, ringworm of such animals as the chinchilla, and the fox presents serious economic problems. During the past several years, the Mycology Laboratory has received clinical specimens from a number of ringworm epizootics in chinchilla ranches both in this country and in Canada.

Last, but perhaps not the least important reason for the correct diagnosis of ringworm in animals, is the fact that ringworm lesions resemble many other dermatologic conditions, and misdiagnosis both in human medicine and in veterinary medicine has led to much expensive, persistant, and unavailing "ringworm treatment" for cases of seborrhea, eczemas, vitamin deficiencies, and other dermatologic conditions.

Diagnosis

The study and control of ringworm in animals depends upon the correct diagnosis of the disease. There are two important steps involved, the first being the actual demonstration of fungus elements associated with a lesion. In *M. canis* infections, presumptive evidence of the presence of fungus invasion may be obtained by examination of the animal or of epilated hairs under a Wood's lamp. However, final evidence of fungus infection in this type of ringworm infection as well as in other types, which do not show fluorescence under a Wood's lamp, depends on observing fungus elements — spores and mycelia — by microscopic examination of the clinical materials. Secondly, although the manner of

Chart I. Study of Clinical Materials in Diagnosis of Ringworm in Animals—Microsporum Infections

Fungus species	Animals affected	Location and Appear. of lesions	Wood's light exam.	Direct Exam. in NaOH mounts Skin Scrapings	Hair
Microsporum canis Syn: *M. lanosum* *M. felineum* *M. equinum*	Common: Cat Dog Occasional: Horse Monkey	Scattered lesions, especially on head. but may be on body, legs, or tail. *Kittens and puppies*: Diffuse scaliness and irregular patches of hair loss. Infections may be very extensive over the body. Adult cats and dogs: Well defined areas of alopecia; or areas showing scaliness or heavy white crusts. *Horses*: Lesions as above in areas where harness rubs skin, "girth itch."	Bright yellow-green fluorescence.	Mycelium & chains of spores.	Sheath of small spores (2-3 u) in mosaic completely surrounding hair at base. Mycelium seen in interior of hair.
Microsporum gypseum Syn: *M. fulvum* *Achorion gypseum*	Occasional: Dog Cat Horse	Often a single lesion on head or feet. Well defined patches with loss of hair and some scaliness in central area. Dense scaling or heavy crusts at edge of lesion. Crusts may be thick, yellowish, and moist. Hairs loose at edge of lesion often seen adhering to crusts. Favic-type lesions have also been described.	Very little or no fluorescence.	Mycelium & chains of spores.	Sheath of small spores (2-3u.) in mosaic as seen above, or large spores in chains or in irregular masses on surface of hairs. Mycelium seen in interior of hair.
Microsporum audouini	Rare: Dog Monkey	A circinate eczematous plaque near mouth has been described in the dog. Areas with slight scaling and irregular loss of hair, and with intense itching, has been reported in the monkey.	Bright yellow-green fluorescence.	Mycelium & chains of spores.	Sheath of small spores (2-3 u) in mosaic completely surrounding base of hair. Mycelium seen in interior of hair.

hair invasion by the fungus parasites, as seen under the microscope, will give some information concerning the fungus species involved, the final step to determine the fungus species responsible is the inoculation of culture tubes and study of the fungus culture recovered.

Unfortunately, the literature presents little information as to the prevalence of ringworm infections in animals or of the relative prevalence of the various fungus species in animal

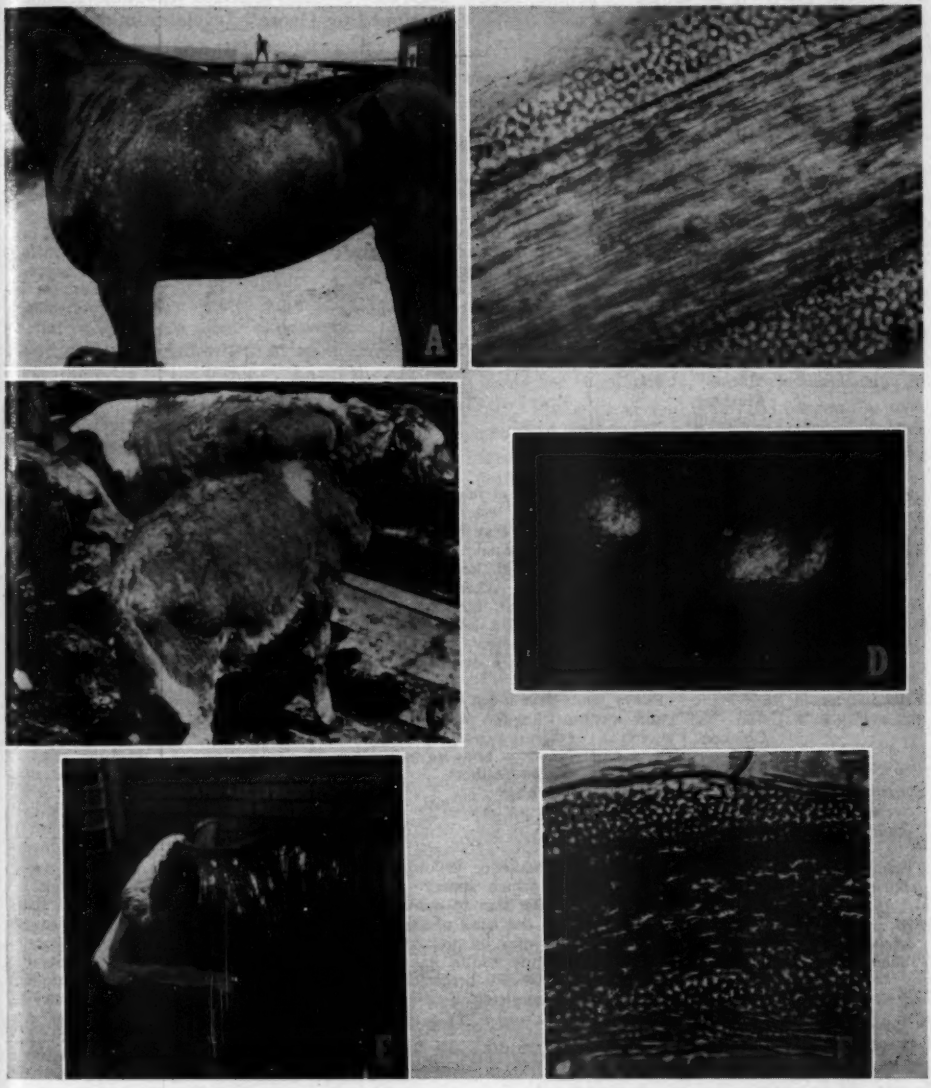

Fig. II. (A) Trichophyton mentagrophytes ringworm in the horse. (Courtesy Drs. E. G. Batte and W. S. Miller, New Jersey.)
(B) Hair infected by Trichophyton mentagrophytes. Median view shows sheath of large spores in chains.
(C) Trichophyton verrucosum ringworm in calves. Heavily crusted lesions are seen along top of neck and back, and at the base of the tail. (Courtesy Dr. R. G. Carney, Iowa City, Iowa.)
(D) Close-up of heavily crusted lesions of Trichophyton verrucosum ringworm in a cow.
(E) Trichophyton verrucosum ringworm in a calf. Heavily crusted lesions on the neck and the face. (Courtesy Dr. F. P. Jaggi, College Station, Texas.)
(F) Hair infected by Trichophyton verrucosum. Shows sheath of large spores in chains. Mycelium can be seen in interior of the hair.

ringworm infections in the United States. This is largely the result of the fact that few veterinarians carry out either microscopic examinations or cultural studies, a deplorable situation since such procedures are not difficult. The equipment required is simple, and the steps involved may be performed easily.

One of the principal difficulties encountered in the isolation of pathogenic fungi from ringworm-infected animals is the fact that hair and skin scrapings usually are heavily contaminated with bacteria and saprophytic fungi. The use of the selective isolation medium developed by Georg[29] (cycloheximide medium

Chart II. Study of Clinical Materials in Diagnosis of Ringworm in Animals—Trichophyton Infections

Fungus Species	Animals affected	Location and appear. of lesions	Wood's light exam.	Direct Exam. in NaOH mounts Skin scrapings	Hair
Trichophyton mentagrophytes Syn: *T. granulosum* *T. gypseum* *T. asteroides* *T. caninum* *T. felineum* *T. quinckeanum*	Common: Horse Occasional: Cow Dog Cat Opposum Fox Rabbit Mouse Muskrat Chinchilla Guinea pig Monkey	Most common on head near mouth or at base of tail. May be anywhere on body. Lesions irregularly defined areas of alopecia with considerable scaling. Heavy crusts may form. Occassionally pustules may form at edge of lesion and suppuration beneath crusts. *Horse*: Commonly in areas where harness rubs skin, "girth itch."	No fluorescence	Mycelium & chains of spores.	Sheath or isolated chains of spores (3-5 u.) lying on surface of hair. Mycelium seen in interior of hair.
Trichophyton verrucosum *Syn*: *T. faviforme* *T. album* *T. discoides* *T. equinum* *T. caballinum*	Common: Cow Occasional: Horse Sheep Dog Donkey Goat	Usually on head but may be scattered on body, legs, or tail. (In calves lesions may be very extensive). Coin-sized or larger distinct plaques with heavy greyish-white crusts. When crusts are removed, moist, bleeding areas are seen. Old lesions lose the heavy crust, show scaliness and broken-off hair stumps.	No fluorescence	Mycelium & chains of spores.	Sheath or isolated chains of large spores (5-8 u.) lying on surface of hair. Mycelium seen in interior of hair.
Trichophyton gallinae *Syn*: *Achorion gallinae*	Rare in U. S.: Chicken Turkey Occasional: Dog	Heavy white crusts esp. on comb and wattles ("favus" or "white comb"). In rare cases, crusts have been found on body as well. Does not involve feathers.	No fluorescence	Mycelium & chains of spores.	Sheath or isolated chains of large spores (5-8 u.) lying on surface of hair. Mycelium seen in interior of hair.
Trichophyton schoenleini *Syn*: *Achorion schoenleini*	Not reported from U. S.: Cat Dog Mouse	Heavy greyish-white or yellowish cup-like crusts which appear "stuck-on" to the skin in masses, particularly on the head of the animal. Crusts may be pierced by long, dull-grey brittle hairs. Hairs do not usually break off but fall out completely.	None or dull-grey fluorescence	Mycelium & masses of large irregular spores, some in chains.	Strains of mycelium found inside the hair running along its length. Spaces with air bubbles and fat droplets are characteristically seen in the hair. No spores seen on outside of hair.
Trichophyton megnini *Syn*: *T. rosaceum* *T. vinosum*	Not reported from U. S.: Cow Dog	Clearly circumscribed heavily crusted lesions, or areas showing only slight scaling and hair loss.	No fluorescence	Mycelium & chains of spores.	Sheath or isolated chains of large spores (5-8 u.) lying on surface of hair. Mycelium seen in interior of hair.

described later in the text), containing several antibiotics which inhibit the development of both bacteria and saprophytic fungi has been of great value in the isolation of pathogenic fungi from heavily contaminated clinical material. It is hoped that the advantage offered by this medium will stimulate study of ringworm in animals, and will encourage the use of more accurate methods in the diagnosis of this disease.

I. METHOD FOR COLLECTION OF CLINICAL MATERIALS

A. Large Animals: Cattle, horses, and others.

Equipment. Sterile scalpels, clean paper envelopes.

Method. Scrape scales and hairs from affected areas into a clean paper envelope. Best results are obtained when scrapings are made from the edge of the lesions. Label the outside of the envelope.

Do not put scrapings into closed containers such as rubber stoppered test tubes. (If the specimen is allowed to remain moist, contaminating bacteria and saprophytic fungi will grow on the hairs and skin scrapings making the isolation of the pathogenic fungus more difficult. Spores of pathogenic fungi are resistant to drying).

B. Small Animals: Dogs, cats, and others.

Equipment: Sterile scalpels, sterile forceps, Wood's lamp (if available),* clean paper envelopes.

Methods. If a Wood's lamp is available, examine animal in a completely darkened room. If fluorescing hairs are seen (hairs which glow a bright yellow-green) either scrape off or pluck out these hairs. Place in a sterile Petri dish or a clean paper envelope.

If no fluorescing hairs are seen, re-examine the animal under normal lighting conditions. Scrape or pluck hairs from *edges* of affected areas. Place in sterile Petri dish or in clean paper envelopes; label.

Clinical materials (hairs and skin scrapings) from suspected cases of ringworm should be taken to a laboratory for direct examination and cultural studies. If the specimen is to be mailed to a mycology laboratory, the envelopes should be folded and placed in a regular metal-and-cardboard mailing container. It is well to accompany specimen with data concerning kind and age of animal, location and character of the lesions, geographic location from which the specimen is submitted, and information as to whether there has been evidence of human contagion.

*The Wood's lamp is an ultraviolet light with a special nickel oxide filter which allows maximum radiation at about 3,660 angstrom units. Several commercial lamps are available in small hand models which are useful for diagnosis of some types of both human and animal ringworm.

II. METHODS FOR STUDY AND CULTURE OF CLINICAL MATERIALS

A. Direct Examination of Clinical Material.

1. If a Wood's lamp is available, the dish or envelope of skin and hair scrapings may be examined in a darkened room. If fluorescing hairs are seen, these should be selected for further examination and culture. If no flurorescence is seen, hairs and skin scrapings may be selected at random from the clinical material for study. Broken-off hairs, or hairs which show greyish-white collarettes at their bases are most apt to be infected.

2. Place a hair and a few skin scrapings in a drop of 10% sodium hydroxide or potassium hydroxide on a glass slide. Add a coverslip and heat the slide by placing on the microscope lamp or by holding for a few seconds over a Bunsen burner. DO NOT BOIL. If a Bunsen burner is not available, allow the preparation to stand 15 to 20 minutes for clearing before examination.

3. Examine under the low power of the microscope with reduced light for the presence of fungus elements. Note the size and distribution of spores on the hairs. For more accurate study, examine with the high power lens (450X or 475X).

The important characteristics of the ringworm fungi seen by direct examination of tissues are shown in charts I and II.

B. Culture of Clinical Material.

1. *Media.* Sabouraud's dextrose agar at pH 5.5 is the standard medium used for the isolation of the ringworm fungi from clinical materials. Such a medium is available in powdered form from several commercial sources. However, for the isolation of the ringworm fungi from heavily contaminated materials such as animal hair and skin scrapings, better results may be obtained by use of the cycloheximide medium. Cycloheximide medium is a Sabouraud agar to which has been added several antibiotics: Penicillin, streptomycin, and cycloheximide (acti-dione). Penicillin and streptomycin serve to inhibit the growth of contaminating bacteria, and cycloheximide inhibits the growth of many of the

Chart III. Cultural Characteristics of Ringworm Fungi Isolated from Animals

Fungus species	Colony-Sabouraud Dextrose agar (with or without antibiotics).	Microscopic mount
Microsporum canis Syn: *M. lanosum* *M. felineum* *M. equinum*	Growth—Very rapid. Flat. Regular border. Surface—white to yellowish tan. First fine, silky aerial growth; later fluffy with wooly areas. Pigment on reverse: Bright yellow.	Large numbers of septate, spindle-shaped spores (macroconidia). These show a thick wall with a rough surface. Many cells, (6-10) in a mature spore. Small single-celled, (microconidia) are only rarely seen.
Microsporum gypseum Syn: *M. fulvum* *Anchorion gypseum*	Growth very rapid. Flat. Irregular border. Surface—cinnamon to light tan. Coarsely granular. Develops tufts of white fluffy growth. Pigment on reverse: tan.	Large numbers of separate, elliptical spores (macroconidia). Wall—rough surfaced but slightly thinner than those of *M. canis*, 3-4 cells in a mature spore. Small single-celled spores, (microconidia) are only rarely seen.
Microsporum audouini	Growth slow. Flat. Regular border. Surface—white to tan. Velvety to felt-like surface growth. Pigment on reverse: tan or slightly salmon colored at center.	Usually mycelium and large swollen cells (chlamydospores) only. Occasional strains may show a few small single-celled spores (microconidia) and more rarely, irregularly shaped thick-walled septate spores (macroconidia).
Trichophyton mentagrophytes Syn: *T. granulosum* *T. gypseum* *T. asteroides* *T. felineum* *T. caninum* *T. quinckeanum*	Growth rapid. Flat or heaped and irregularly folded. White to cream, downy, velvety or granular surface. Pigment on reverse: yellow to rose to deep red-brown.	Large numbers of oval to round single-celled spores, (microconidia). Rarely seen in most cultures are the large several-celled spores, (macroconidia). These are club-shaped and have a thin, smooth wall and 3-5 cells.
Trichophyton verrucosum Syn: *T. faviforme* *T. album* *T. discoides* *T. equinum* *T. caballinum*	Growth—very slow. May not appear until 10 to 14 days. Colony usually small, heaped and folded. Surface—white to greyish. Moist and smooth or slightly velvety. Growth more rapid at 37 C., or upon the addition of thiamine to the medium. Pigment on reverse: None.	Thin irregular myelium with swellings (chlamydospores) which occur in large numbers, often in chains. A few single-celled spores (microconidia) may be found. Microconidia may be numerous on thiamine-enriched media.
Trichophyton gallinae Syn: *Achorion gallinae*	Growth—rapid. Flat but develops irregular folds. Cracks may appear on summits of folds. Surface—downy to fluffy. Usually white but may be pink. Pigment on reverse: A light strawberry-red. Pigment diffuses through entire medium which becomes deep red.	Large septate spores (macroconidia) may be very numerous. They range from 2-10 cells, have smooth, double-contoured walls. Single-celled spores (microconidia) rare.
Trichophyton schoenleini Syn: *Achorion schoenleini*	Growth slow. Usually heaped and irregular fringed border. Occasional strains grow submerged in the agar. Surface—cream to yellowish or grey. Moist and smooth or irregularly covered with a fine, white, downy surface growth. Growth not stimulated by incub. at 37 C., or by addition of thiamine to the medium. Pigment on reverse: None.	Irregular mycelium with thick branches ending in complex clubbed ends (chandeliers). Large irregular swellings (chlamydospores) are common. Few small single-celled spores (microconidia) occasionally seen in downy surface growth.
Trichophyton megnini Syn: *T. Rosaceun* *T. Vinosun*	Slow growing, flat, usually with regular radial groves. Surface—velvety, at first white, later rose. Edge of colony smooth often scalloped. Reverse rose to deep red. Pigment does not extend beyond colony.	Small single-celled spores (microconidia) may be numerous. Rare septate spores (macroconidia) may be found. These are pencil-shaped to slightly clavate with thin smooth walls.

saprophytic fungi. The character of the fungus growth is not changed by the presence of these antibiotics but the isolation of the ringworm fungi is greatly facilitated[8]. The preparation of this medium is described below.

2. *Inoculation of Tubes.* Tubes are inoculated by placing hairs or skin scrapings (use a sterile scalpel or inoculating needle) on the slanted surface of the medium. It is well to push the specimen partially into the agar.

3. *Incubation.* Tubes may be incubated at room temperature (25 to 30 C.). In the case of clinical material from cases of suspected cattle ringworm, it is well to incubate some of the tubes at 37 C. also. (*T. verrucosum*, the common cause of cattle ringworm, is slow to develop at room temperature).

4. *Examination of Cultures.* Tubes should be examined every four to six days. If saprophytic fungi appear, it is well to subculture to fresh tubes any colonies suspected of being ringworm fungi. Culture tubes should be held for at least four weeks before being considered negative. Colonies should be studied to determine both the gross and the microscopic characteristics of the fungus isolated. The important cultural characteristics of ringworm fungi found in any animals are listed in chart III. They also may be found in any standard textbook on medical mycology.

Formula of the Selective Isolation Medium for Pathogenic Fungi

Cycloheximide - Penicillin - Streptomycin Medium.* Sabouraud dextrose agar is prepared by the usual method and distributed into Erlenmeyer flasks—100 ml. per flask. The medium is autoclaved and allowed to cool to 45 C. in a water bath. The various antibiotics are added to give the following final concentrations:

Cycloheximide (acti-dione)	0.5 mg. per ml.
Penicillin	20 units per ml.
Streptomycin	40 units per ml.

The complete medium should be distributed aseptically into sterile test tubes in 5 to 8 ml. amounts. The tubes then should be slanted and allowed to harden before use.

Stock Cycloheximide Solution. Place 250 mg. crystalline cycloheximide (acti-dione) in a 50 ml. volumetric flask. Add 5 to 10 ml. acetone to dissolve, then bring to volume with distilled water (the pH of the water must be previously adjusted to 6.5 - 6.8). Sterilize by autoclaving at 120 C. for 15 min. or by filtration through a Seitz filter and store at 5 C. (Cycloheximide prepared in acid solution will remain stable at 5 C. for six months.) Add 10 ml. stock cycloheximide to 100 ml. cooled medium to obtain 0.5 mg. per ml.

Stock Streptomycin Solution. Streptomycin —1,000,000 units/gm.

Dissolve 1 gm. in 20 ml. of sterile physiological saline giving a solution containing 50,000 units/ml. Add 4 ml. of this to 46 ml. of sterile saline. This forms the stock solution containing 4,000 units/ml.

Add 1 ml. of stock streptomycin solution to 100 ml. of cooled medium to obtain 40 units/ml.

Stock Penicillin Solution. Add 20 ml. sterile physiological saline to a vial containing 200,000 units of crystalline potassium penicillin, giving a concentration of 10,000 units/ml. Add 10 ml. of this to 40 ml. of saline, giving a stock solution containing 2,000 units/ml.

Add 1 ml. of stock penicillin solution to 100 ml. of cooled medium to obtain 20 units/ml.

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*Acti-dione, trade name for cycloheximide, distributed by the Upjohn Company, Kalamazoo, Michigan. Trade names are used for identification purposes only and their use does not constitute endorsement of the product by the Public Health Service.

NOTE. For the isolation of *T. verrucosum* from animal hairs, it is an advantage to add thiamine (0.01 mg./liter) to the above medium. Both thiamine and cycloheximide are heat stable at an acid pH, and therefore may be autoclaved in the medium if desired. The penicillin and streptomycin, however, are thermo-labile and must be added to the medium after autoclaving.

The author wishes to acknowledge the assistance of John P. Gust and Erylene O. House of the Audio-Visual Training Branch of the Communicable Disease Center in the preparation of illustrative materials.

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Diagnostic Test for Liver-Fluke Ova

Pertinent omissions and errors occurred in preparing abstract of paper by Dennis *et al.*, that appeared in VETERINARY MEDICINE for February, 1954, page XXXII. The original article, A New Laboratory and Field Diagnostic Test for Fluke Ova in Feces, appeared in the *Jour. Am. Vet. Med. Assn.*, 124:47 (Jan.), 1954.

Instead of adding 15 cc. of liquid detergent as given, instructions should have read, "add 15 cc. of a stock detergent solution, consisting of 5cc. of joy® or glim® and 985 cc. tap water plus eight drops of 1% alum solution to the above. These directions must be followed carefully else results are not dependable.

No time limits were mentioned in the abstract. They are important as it has been found that five minutes minimum and 15 minutes maximum between sedimentation and staining gave most accurate results. The whole point of the problem is to drop the fluke ova to the bottom of the centrifuge tube, keeping as much debris suspended as possible.

Addition of one to three drops of tincture of iodine is important as too much ruins the field.

Problems In The Treatment Of Pet Birds†

IRVING E. ALTMAN, D.V.M., Brooklyn, New York

TO initiate a brief discussion of problems in handling pet birds, I should like to consider a few factors concerning feeding of normal, healthy birds.

Canaries are fed on a mixture of plain canary seed and rapeseed in approximately equal proportions. Some birds eat more of the canary seed, which is high in carbohydrates, and become obese. Adjustment of proportions, or supplying an exclusive rapeseed diet may be indicated to overcome objectionable obesity. Supplemental food such as fresh greens, hard boiled eggs, stimulating seed, as song foods, and condition foods also are advisable.

Parakeets are fed on a mixture of canary seed, millet seed, and steel cut oats. The young are fed the mixture in the proportion of 3-1-1. Adults are fed one part canary seed, two parts millet, and one part oats. Parakeets do not eat many extraneous foods but if they do, various specially prepared foods are available and recommended. Fresh greens, carrots, tomatoes, fruits, and hard boiled eggs also are beneficial.

Parrots live essentially on sunflower seeds and will eat practically anything offered. Meat and bones usually are considered detrimental. Parrots and parakeets require a high vitamin A diet.

Overgrown Beaks

One of the simple problems in practice is overgrown beaks. These should be cut with nippers to normal form, care being exercised in cutting the upper bill so as not to invade vascular area.

In addition to growing too long, bills may grow irregularly, longer on one side than on the other. When the upper beak is longer on one side, then the lower grows longer on the opposite side because of unequal wear or closure. These irregularities must be trimmed down to normal with nippers. In accidents, the lower nib may be split. In such case it must be brought together with silver wire in such manner as to fix in place and prevent motion. In accidents where the whole upper bill is torn off, euthanasia is advised.

Overgrown Talons

Nails often grow excessively and must be cut to avoid accidents such as leg fractures. Again vascular area should be avoided, but if invaded, a small thermocautery or even ordinary kitchen soap rubbed across the bleeding edge will control hemorrhage. By holding the nail before a light, blood vessels can be seen easily.

External Parasites

There are various types of lice and mites that affect birds. All cause unthriftiness, loss of sleep, dermatitis, loss of feathers, and may ultimately be the cause of death. Pet shops sell many remedies for mites and lice, the basis of which is usually pyrethrum. It may be obtained in liquid or powder forms. The latter is preferable in a 2% to 3% mixture with talc. Apply daily for one week, and once a week thereafter. Five or six treatments ordinarily control infestation. Simultaneously, the cage and stand should be sterilized with boiling water or 5% lysol solution to prevent reinfestation.

Stomatitis

Stomatitis occurs in parrots and parakeets more frequently than in canaries. Either injuries, infections, or vitamin deficiencies are generally responsible. In canaries, stomatitis is an outstanding symptom of canary pox. Affected birds may be unable to close their bills because of excessive quantity of cheesey pus collected in the mouth. This must be removed manually, gently, and raw surfaces painted with 1% gentian violet or other mild antiseptic solution.

Sinusitis

Nostrils of most birds are situated between the base of the upper beak and the head. The nostrils, being the external orifice of the respiratory system, are also the opening of the nasal sinuses. This is an unfortunate condition nature has imposed upon birds, for the sinuses

†Presented at the Southern Veterinary Medical Association annual meeting, November 9-11, 1953, Atlanta, Georgia.

must drain upward. Sinusitis is a common anomaly.

It may be caused by drafts, chills, infections, and irritants. Early symptoms are sneezing, with an accompanying slight serous nasal discharge. Birds become dumpy and sleep more than normal. In this stage recovery is rapid if sinuses are irrigated with a mild antiseptic solution, using a blunted hypodermic needle. In more severe cases, the sinus may fill up with a thick, cheese-like pus to a point where both the nostrils and the sinus are greatly distended. In these chronic cases, infection does not appear to alter the general condition for a lengthy period. Pus must be removed with a small eye curret or flattened toothpick. The sinus should be cleaned thoroughly and an antibiotic ointment injected. This procedure must be repeated daily for one week and two or three times a week thereafter until recovery is complete.

An extension of this infection, usually staphylococcal, may be responsible for a periocular inflammation or abscess. Abscesses must be lanced and antibiotic ointment applied. Often systemic administration of antibiotics is required in resistant cases. Injuries and other infections can cause conjunctivitis. The lower conjunctival sac becomes filled with pus and must be thoroughly cleaned. Mild eye ointments are employed until recovery is effected.

Catarracts are fairly common; most often observed in canaries. As yet, there is no available treatment. Usually when discovered the catarract is complete, and occurs in one or both eyes.

Respiratory Infection

The respiratory tract of birds is often the seat of illness. Three conditions of prime importance are: Rhinitis, bronchial catarrh, and pneumonia. One may follow the other, rhinitis leading to bronchitis and then pneumonia. Yet, these three conditions may, and often do, arise as separate entities or infections.

Rhinitis. Various bacterial infections, often initiated by chills and drafts are generally regarded as etiological. Affected birds cough and sneeze. Usually observed is a watery to thick stringy discharge at the nostrils resulting in mouth-breathing. Birds go off feed and develop diarrhea. They become droopy and feathers are ruffled. Sick birds sleep with heads back under the feathers of their back or under their wings.

Bronchial Catarrh. Symptoms similar to those observed in rhinitis, but with aggravated or increased breathing, are noted in bronchitis infection. Abdominal breathing is seen frequently. The tail will give a noticeable jerk, or upward and downward movement, with each breath.

Pneumonia. All the preceding symptoms are exhibited in aggravated form in cases of pneumonia. Birds become dull and inactive, sit huddled on a perch, feathers ruffled, eyes closed, and breathing rapidly and heavily. The head and neck are held extended and rarely turned back. At intervals, the wings at the shoulder are expanded and drawn in again. The auxilliary breathing muscles are brought into play. The bird becomes weaker, leaves the perch to go to the bottom of the cage, and finally collapses.

Treatment of respiratory conditions is keeping the birds warm, 85 to 90 F., supporting resistance with various soft foods, administration of normal saline solution if indicated (1/10 cc. parenterally, daily). Administration of antibiotics in various forms is given according to the severity of the case. I use aureomycin, 25 mg. to one ounce of drinking water if the bird is able to drink, or 50 mg. dissolved in one dram of water. Two drops orally, t.i.d. or, 1 mg. of terramycin®[1] in oil, or 1/10 cc. of penicillin, parenterally. In mild cases, when birds are still eating, I use 50 mg. of aureomycin®[2] in one ounce soft food.

Complications of respiratory infections are air sac inflammations. This often leads to asthma. Asthmatic birds breathe with their bills open and make a clicking sound with each breath. Cortisone acetate is beneficial when used for one to three weeks. Dissolve 25 mg. cortisone in 1 dr. of water and give 1 gtt. b.i.d. for small birds and 2 gtt. b.i.d. for larger birds.

Air sac ruptures occur either from accidents or inflammation. The rupture permits air to escape, usually under the skin, causing emphysema. Create a fistula in the skin by surgery, and the condition will right itself. The simplest treatment is to puncture the blown-up skin in one or two places with a sterile hypodermic needle.

Intestinal Disorders

The intestinal tract has its share of troubles. Parrots often will eat anything and usually are given everything. Severe hemorrhagic enteritis may ensue.

This is an acute condition and should have immediate attention. First, withhold all food

®[1]Chas. Pfizer & Co., Brooklyn, N. Y.
®[2]Lederle Laboratories Division, Pearl River, N. Y.

for 24 hours. Birds become thirsty and will drink quantities of fluid. Give 1 dr. of paregoric in 2 oz. of water daily for 24 to 48 hours. Recoveries are usually dramatic.

Simple enteritis, as indicated by diarrhea, is treated with mild saline laxatives in the early stages. Useful for this purpose are magnesium sulfate or Glaubers salts, (20 gr. to 1 oz. of water) for 24 hours and no food for 12 hours. In mild diarrheas in parakeets, three drops of buttermilk will alter the intestinal flora and reverse the condition. In more aggravated forms, aureomycin in the drinking water for four of five days will effect recovery. In protracted cases exhibiting great malaise, parenteral antibiotics plus saline injections are of value.

Infectious Diseases

Time will not permit a complete discussion of infectious diseases such as canary pox, infectious hepatitis, psittacosis, yet a few words on psittacosis may be of interest. This is a difficult disease to diagnose. Symptoms are vague and include loss of appetite, ruffled feathers, and a peculiar diarrhea in which droppings are olive green. If suspected, an autopsy can be made. Lesions observed are splenic enlargement, liver is greatly enlarged and multiple small abscesses are seen under the serous coat. It gives an appearance of salt having been sprinkled on it. Since psittacosis is highly contagious to man, suspected bird should be sent to federal laboratory for diagnosis. I might mention that in homes where psittacine birds are kept, and human pneumonia develops, it is not necessarily psittacosis. Aureomycin is said to cure psittacosis.

Nephritis is surprisingly common in birds. It occurs more frequently in canaries than other birds and appears as an edema of the legs. Legs become red, swollen, and medical blood vessles of the metatarsal bone stand out engorged and very red. Treatment is menthenamine. Dissolve 5 gr. in 1 oz. of drinking water daily for two weeks, or antibiotics in the drinking water for one week. To help reduce leg swellings, soak in Burrow's solution for ten minutes at a time, three times a day. I posed the question of urine analysis for birds to a noted clinical pathologist but he could not solve the problem.

Traumatism

I have not mentioned fractures of the legs wings. This subject alone could take up the time alloted. Fractures are common and usually not difficult to treat. The principle of treating long bone fractures is the flap splint. The easiest fracture to set is the middle metatarsal. As assistant holds the canary on its back, fractured leg up and towards the operator in one hand, and extends the leg with the opposite hand by holding the long center toe and gently pulling upwards. A piece of adhesive tape, one-half inch wide and four inches long is used. After the bones are manipulated and set, adhesive tape is applied around the leg allowing a flap, one-eighth inch wide, to extend on each side. When four or five turns or layers are applied, excess adhesive is cut off. With the finger, pinch the flap to conform to the leg tightly. Then a strong pair of artery forceps are used to tighten the flap completely. If properly applied, the bones will be held fixed, circulation will not be disturbed, and healing will be complete in ten to 14 days. I usually examine the leg in one week for adjustment if necessary and remove the splint in two weeks. If the fracture involves the lower third of the metatarsus, a narrow band of adhesive passing under the foot and up along the sides of the leg must be incorporated in the splint. It is desirable, when splinting legs, to keep them in as near normal position as possible. Yet, in a fracture of the upper third of the metatarsus, the leg must be in complete extension, including the tibiotarsal joint, to get good results.

In lower third tibial fractures, the same flap splint is applied but modified to keep the tibiotarsal joint flexed, if necessary, at right angles. This brings the adhesive below the metatarsal bone and the bird may rest upon it.

Upper third and middle fractures of the tibia are treated with the same flap splint, conforming to the shape of the leg. Since the thigh is shaped like an inverted cone, it becomes necessary to prevent the splint from slipping downward. Flexing the tibiotarsal joint accomplishes this.

Since the tibia is enclosed within and under the skin of the body, it is difficult to treat directly. By flexing the leg completely and holding it close to the body it can be held by a feather sling. The feathers of the body on either side of the flexed leg are brought down and around the leg and tied together. This sling is cut in two weeks and good recovery generally ensues.

A fractured toe usually is set by using its neighbor toe for a splint and holding together with collodion.

Fractures of the wing are not uncommon. The usual fractures occur in the humerus,

radius, and ulna. Examine a bird and notice how the wings are flexed and set against the body. It is easy to see how difficult it would be to place a splint on either the humerus, radius, or ulna. Therefore, I devised a plan to use the body as a splint and have obtained good results.

A fractured wing always droops. The degree of drooping of the wing depends upon the severity of the fracture. In setting the fracture, lift the wing to its normal position. Occasionally this automatically reduces the fracture. Fractures with severe displacement are reduced by gentle manual manipulations. When the wings are set and in normal position, place the wing tips of the fractured limb upon the wing tips of the opposite wing.

The surgeon now hands the bird to his assistant who grasps the posterior part of the bird between his fingers so that he holds the wings as set (the legs extended posteriorly) the posterior third of the body and the tail. If the left wing is fractured the assistant holds the bird with his right hand. If the right wing is fractured the bird is held in the left hand so that the fractured wing faces the surgeon.

A six-inch length of adhesive one-half inch wide is placed around the body anterior to the legs holding the wings to prevent extension. This strip of adhesive is placed on the ventral edge of the wing facing the surgeon carried over the back and around to meet itself, leaving the end to hang temporarily.

Another length of one-half inch width adhesive is placed horizontally over the back of the bird. Starting at the anterior edge of the adhesive that goes around the body, it is carried back over the wing tips and folded under for a distance of one-half to one inch. The adhesive carried around the body is then carried over the horizontal strip to tie it down.

The wing is now set but if left this way the bird will be top heavy and unable to stand. Therefore, a piece of one-half inch wide adhesive is placed around the wing tips, tying the wing tips together and, more important, acting as a counterbalance for the bird. This splint remains in position for two weeks. It is removed by cutting the adhesive under the breast and on each side of the wing tips (counterbalance). Gently pull off the adhesive holding the base of the feathers. Ether may be used to loosen.

Summary

The foregoing are a few of the problems involved in pet bird practice. I have not discussed many conditions such as broken feathers, feather pulling, dermatitis, moulting, scaley legs, ascites, apoplexy and epilepsy, paraplegias, oil gland disease, abscesses, gout, tumors, cloacal proplapse and many other anomalies.

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Leptospirosis

(*Continued from page 152*)

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The life cycle of a parasite must be thoroughly understood before effective control measures can be applied.

EDITORIAL COMMENTS

Mailing Rate Increase

Two 10% increases in second-class postal rates, the first effective in 1952 and the second in 1953, will be followed by a third in April 1954.

These significant increases in publication costs have failed to relieve the postal deficit everyone is talking about. As a matter of fact, if second-class postal rates were increased 100%, which no one seriously suggests, only $45,000,000. would be raised, and many publications would be forced out of business, particularly smaller ones having restricted circulation. The 42% increase now proposed by the Postmaster General will yield only $20,000,000., and injure many useful journals.

Remembering that the total postal deficit is variously estimated between $350,000,000. and $700,000,000., it can be seen that a 30% increase in second-class rates can be expected to produce only small deficit-reducing revenue, whereas equal increases in first-class rates (for handling which matter the Department is organized) would make substantial reductions in deficit. If first-class mail would be increased but one cent per ounce, $250,000,000. would be produced.

There are many ramifications to the problem. Publications — like this one — and most others, do not want government subsidies. They are convinced that they serve by furthering adult education, enhancing business activity, and thus perform a public service. Why should the Post Office Department, of all government departments organized as service groups, be required to operate as self-supporting? Certainly, all were intended to be at least partially supported by appropriations from public funds to render a service universally enjoyed by every citizen. Increased postal rates are, in a sense, increased tax levies.

There is much confusion about cost figures and other matters that require searching analysis. It is to be hoped that the Carlson Committee of the Senate will advance some recommendations having sensible values.

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After 40 years of rather successful control of hog cholera by virus and serum immunization, there are many questions in regard to the disease and the causative virus that remain unanswered.

Dispensing Practices

Dispensing Experiences in My Practice, was the subject of a full length presentation by Dr. E. W. Krueger, Evansville, Wisconsin, before the Illinois Veterinary Medical Association's annual meeting in Chicago recently.

Doctor Krueger stated that dispensing some therapeutic agents for administration by owners was an important phase of his practice. Manufacturer's labels are not removed so that the client knows what he is getting. Furthermore, dosages are frequently altered as indicated, pointing up the necessity for intelligent treatment to fit the individual case. He also stated that the prescription method is employed in his farm practice. These are filled later, either at his office or at the drug store.

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Science News Letter for February 13, 1954 states that, "The prospect of a 15-cent cup of coffee has shaken the foundation of the coffee drinker's world, but in the future we may not have good coffee at any price."

Coffee plantations in all parts of the world except Latin America have been devastated by a ruinous plant rust. Rust-resistant species of trees bear beans yielding an inferior coffee. American scientists are concerned, and effort is being made to assist coffee growers through the Point Four program in the problem of rust control, or breeding for resistance. Until the problem is solved, coffee woes may be multiplied.

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Dr. D. C. Boughton, parasitologist, E. I. DuPont de Nemours and Company, Wilmington, Delaware, is authority for the statement that a relatively small number of internal parasites can cut average daily gain of livestock drastically. He stated also that a single parasite may result in the loss of as much as 1.6 lb. of weight gain during a four-month growth period.—*Livestock Conservation, Inc.*

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The birth rate in the Virgin Islands was low until the United States Government introduced canned tomatoes as a commercial product. This addition of vitamin C to the islander's diet was followed by substantial increase in their birth rate.

A.V.M.A. 91st Annual Convention — Seattle, August 23-26, 1954

Seattle, Washington, will be the host city for 1954 annual meeting of the American Veterinary Medical Association — the first time that this Pacific Coast city has so served — and the first A.V.M.A. session to be held in the Pacific Northwest since 1925.

Brig. Gen. James A. McCallam
President A.V.M.A.

The chief city of the state of Washington and the largest city of the Pacific Northwest, Seattle is situated on a series of hills overlooking its fine harbor on Puget Sound which lies to the west. To the east is freshwater Lake Washington backed by the Cascade Mountains; to the south, rises snow-capped Mt. Rainier. There are many other points of interest including the campus of the University of Washington; the mile-and-a-quarter long Floating Bridge, built on pontoons, across Lake Washington; beautiful parks, fine stores, and excellent restaurants. There is much vacation-time appeal in Seattle and the entire Pacific Northwest.

Headquarters have been designated as the Olympic Hotel but a housing bureau will function to receive, process, and confirm all hotel reservations. The Metropolitan Theater, which adjoins the Olympic Hotel, will be used for general sessions, some sectional meetings, and television demonstrations.

Special tours are being arranged by A.V.-M.A. headquarters in Chicago. Routes of travel to and from Seattle and extended tours to Alaska and Hawaii are being arranged for those interested in combining attendance at this meeting with a summer vacation.

Dr. E. E. Wegner, Seattle, is general chairman of the committee selected to carry out detailed planning and arrangements for this convention. He will be assisted by Dr. P. M. Hinze, Carnation, who will serve as vice-chairman, Dr. D. W. Clarke as secretary and Dr. J. C. Kraft as chairman of the Executive Committee. Other committee chairmen have been selected to plan and supervise the many and varied functions scheduled.

Attendance is expected to be large. Convention goers are promised a program that will consider current practice problems and results of experimental studies.

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New Provisions of the California Brucellosis Control Program

New provisions of the brucellosis control program in California now provide for optional vaccination for cattle over one year of age.

Cattle vaccinated under the new program will be identified by an "A. V." tattoo in the right ear followed by the last numeral of the year vaccinated. Animals eligible for vaccination are those which have been tested officially and found negative to the blood agglutination test ten days prior to vaccination, in cases of California stock, or 30 days in cases of cattle originating outside the state.

Testing and vaccination authorized under these regulations may be performed only by licensed veterinarians. Cost of test and vaccination will be paid by owners.

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Artificial Insemination of Chinchillas

Search for higher quality in chinchillas has resulted in a technic for artificial insemination of these essentially monogamous females. This report by the American Association for the Advancement of Science answers, in part, perplexing problems of breeders attempting to establish selective breeding programs.

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Dr. R. E. Linders, Sparta, Illinois, states that all cases of mucosal disease observed in his practice have occurred in animals under two years of age.

Poliomyelitis Vaccine Program

The National Foundation for Infantile Parlysis is sponsoring an attempt to control poliomyelitis by mass vaccination of 500,000 to 1,000,000 second-grade school children during 1954. Evaluation of products used can not be made until 1955 and after survey of experience. The cost of the vaccine to be used and the testing program is estimated at $7,500,000., all derived from March of Dimes revenue.

Dr. Jonas Salk and his associates at the University of Pittsburgh developed the vaccine. Members of Doctor Salk's family and about 700 children in the Pittsburgh area have been vaccinated during the last two years. The 1954 vaccinating program has started in Pittsburgh, Doctor Salk assisting in administration procedures.

Vaccine is produced by the tissue-culture technic or incubation in artificial media containing monkey tissue. Virus of all three types are employed. Further preparation includes inactivation with formaldehyde and suspension in mineral oil to slow absorption. Each lot is tested at the Pittsburgh Laboratories for purity, safety, and antigenicity. Mass production of vaccine has been assigned to commercial laboratories having proper facilities on a nonprofit basis. These include Cutter Laboratories, Berkeley, Calif., Eli Lilly, Indianapolis, Ind., Parke, Davis & Co., Detroit, Mich., Pitman-Moore Labratories, Indianapolis, Ind., and Wyeth Taboratories, Philadelphia, Pa.

Comment. While the present studies support use of live, adapted virus vaccines in many diseases, past experience by veterinarians in the use of equine enchephalomyelitis vaccine (a formalized, inactivated product) has been successful in the control of sleeping sickness in horses. Test animals have been shown to withstand enormous virus challenge.

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Vitamin A therapy may be of value in relieving symptoms of bovine hyperkeratosis if the disease has not advanced to an irreversible stage. After removal of the toxic factor or factors, and assurance of high vitamin A intake, supportive treatment, good nursing care, and adequate nutritious feed are recommended.

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Disease control officials and practicing veterinarians must have the cooperation of agricultural groups to control effectively any prevalent livestock disease.

A.A.H.A. New York City, May 5-8, 1954

Details of the program for the 21st annual meeting of the American Animal Hospital Association have been announced.

Sessions at New York's Hotel Statler beginning on May 5 and closing on May 8, 1954 will feature authorities on canine diseases, a two-hour television presentation and discussion illustrating the value of the clinical laboratory in a small animal practice, prepared movies of surgical technics, management matters and employee and client relationships, and a special program on the subject of ophthalmology.

Entertainment features include a gala reception and banquet for the president on Friday evening and a hospitality booth that will serve visitors by assisting in planning visits to many attractions in the Big City.

Dr. C. P. Zepp, Sr.

Chairman—Program Committee

President Corwin advises that accommodations at the Hotel Statler are the best available. Meeting room, exhibition hall, registration desk, and television studio will occupy practically the entire 18th floor of the hotel. Excellent room accommodations, at reasonable rates, are promised but visitors are encouraged to make reservations early. Cards for this purpose are available from the office of the executive secretary, Dr. Wayne H. Riser, 5335 Touhy Ave., Skokie, Illinois.

POULTRY PRACTICE PROBLEMS

W. R. HINSHAW, D.V.M., Ph.D.
Frederick, Maryland

Vaccination against Fowl Cholera in Ducks

Dougherty (*Cornell Vet.* 43:421, 1953) has reviewed the problem of vaccination of ducks against fowl cholera, and reported on his research using chicken embryo-propagated cultures of *Pasteurella multocida* for preparation of bacterins. He states that in 1950-1951, one-fifth of the ducks raised on Long Island were vaccinated according to the method of Hilbert and Tax (*Cornell Vet.* 28:275, 1938). Hilbert and Tax, using a chemically killed autogeneous broth culture bacteria, claimed to have had a reduction of mortality from an average of 29.4% to an average of 4.1%. Dougherty was not able to repeat the Hilbert and Tax results at a field level, and found that autogenous bacterins failed to control outbreaks in ducks where the mortality was over 50%.

Research work reported by Dougherty was conducted to determine if preparation of bacterins from embryo-propagated cultures, according to the method of Carter (*Am. Jour. Vet. Res.*, 11:252, 1950, and 12:326, 1951) and Carter and Byrne (*Cornell Vet.* 43:223, 1953), would prove more efficient, as they had done for Carter for immunization of mice. Carter used a modification of the technic described by Eveleth, Goldsby and Nelson (*Vet. Med.* 64:73, 1949) for culturing *P. multocida* in the chorioallantoic sac of ten-day-old chicken embryos. According to Eveleth, this technic restores virulency of *P. multocida* cultures, and Carter found that the method increased the percentage of encapsulated bacterial cells. By the method of Carter, cultures are incubated at 37 C. and made into a bacterin by mixing the contents of two eggs in 100 ml. of physiological saline with the aid of a Waring blendor. Sufficient formalin is added to make a final concentration of 0.25%. When this type of bacterin was compared in mice with bacterins made with the same strain from a third embryo passage, but grown then in typtose broth, Carter found that the embryo-propagated bacterin protected mice against 1,700 lethal doses (l.d.) of *P. multocida* while the broth-propagated bacterins protected the mice against only six l.d. of the same challenge culture.

In Dougherty's experiments, he used a Little-and-Lyons Type I (*Am. Jour. Vet. Res.*, 4:110 1943) strain of *P. multocida* isolated from ducks. This type, according to him, is the only one thus far isolated from fowl cholera outbreaks in this class of poultry. The technic for embryo propagation and preparation of the bacterin was essentially that used by Carter except Dougherty used duck embryos. For control bacterins, two were made by a slight modification of the method of Hilbert and Tax, and four commercial bacterins also were used. In all, seven bacterins were compared in two separate experiments, using 21-day-old ducklings. Two inoculations were made at 21 and 28 days, and the challenging doses of *P. multocida* were given ten days after the final immunizing dose, at age 38 days.

The results clearly indicated that the duck embryo cultures produced a more effective bacterin under the conditions used. In the two clinical trials, 2/40 (5%) of the ducklings vaccinated with this bacterin succumbed to the challenge. In the combined groups of ducklings vaccinated with the Hilbert-and-Tax type of bacterin, 23/55 (42%) died when challenged. In the combined groups vaccinated with commercial bacterins, 49/85 (57%) succumbed. Of the unactivated controls challenged at the same time, 44/45 (98%) died.

Duration of immunity tests were conducted with the duck embryo and Hilbert-type bacterins. A total of 83% of the embryo bacterins survived the challenge four weeks after vaccination, as against 17% that survived after vaccination with the Hilbert-type bacterin. By the end of six weeks there was a marked loss of immunity in both lots, as shown by 8/14 (57%) deaths in the embryo-bacterin immunized group and 11/14 (78%) in the Hilbert-type immunized group.

Even though 83% of the duck embryo type bacterin group survived challenges after four weeks, and 57% after six weeks it is promising when compared to the results of the other bacterins. These tests for immunity are too short to be of great economical value. The improvement of immunity by use of the technic described by Dougherty is encouraging however, and it is hoped that further research will develop a bacterin that will efficiently prevent fowl cholera in all types of poultry.

VETERINARY PARASITOLOGY

A. O. FOSTER, B.A., M.A., Sc.D.

Beltsville, Maryland

Anthelmintics in Bovine Practice

There are scarcely a half-dozen chemotherapeutic agents that merit consideration for use against worm parasites in cattle[1] despite the fact that this class of livestock, in terms of income and farm value, is about two-thirds of our livestock industry[2]. By comparison, at least twice this number of anthelmintics is available for sheep, which account for less than 1/25 of this industry. As a class, moreover, the ovine anthelmintics have been more fully studied and, therefore, better standardized. The paucity of good bovine anthelmintics, and of information about them, can undoubtedly be ascribed to many likely causes, but we are concerned more about the fact than with the academic explanation of it. In passing, however, we might note profitably certain influences, basically economic, that probably contributed to the present status; (1) That cost alone probably has precluded much needed research on the bovine host, (2) that helminthic diseases in cattle and calves have been so poorly understood that, until recently, there has been a tendency to discount their significance, particularly in older animals, and (3) that, whatever the absolute losses, the comparative losses from parasitism in cattle are less than in other classes of animals, especially sheep. On a subject which no one knows anything about, however, there is room for the opinion that bovine losses, due to parasites, may prove yet to be of greater magnitude than commonly supposed.

Omitting certain well known anthelmintics of secondary choice, *i.e.* "cu-nic", carbon tetrachloroethylene and copper sulfate, and a few that are used only in helminthic infections of limited occurrence or importance, *i.e.* ascariasis and stephanofilariasis, the present discussion becomes abruptly confined to three primary anthelmintics, namely, phenothiazine, hexachloroethane, and lead arsenate. None of these is used exclusively in cattle, but among them they tell fairly well the practical story of bovine anthelmintics.

The indications and posology of these drugs are well known. Specifically, phenothiazine is the treatment of primary choice in haemonchosis, mecistocirriasis, ostertagiasis, trichostrongylosis (*T. axei*) and oesophagostomiasis, and may be useful in bunostomiasis. It is ordinarily given by the method of choice at a rate of 10 to 20 gm. per cwt. up to a total dose of 60 gm., although low-level and free-choice methods of administration are promising but in the development stage. In epizootics, two or more therapeutic doses are given at intervals of two to three weeks; for control, winter or off-season treatment is often adequate. Hexachloroethane is the primary choice in fascioliasis and amphistomiasis, and is useful in haemonchosis and trichostrongylosis; it is best given by drench in a 50-50 w/v bentonite-water suspension at a dose rate of approximately 10 gm. per cwt. up to a total dose of 100 gm. Lead arsenate is the best available treatment for monieziasis, although its use in the bovine host has been studied insufficiently; as far as determined, doses of 0.5 to 2 gm. of the acid, spray-grade or chemically pure compound, in gelatin capsules, are safe and efficient.

The last of the above-mentioned treatments is entirely reliable, as far as known, and has no fixed contraindications. Hexachloroethane, however, is not effective in animals with severely damaged livers nor against immature flukes, and no adequate control regimen has been developed. Instances of intoxication are rare and unexplained. Phenothiazine is without contraindications, although it produces side-effects such as reddened milk, urine, and feces, and occasional photosensitization; it is, however, like other drugs, of little or no effi-

[1]Foster, A. O., Critical Review of Present-day Treatments of Parasitic Infections, Giving Lists of Drugs. XV International Veterinary Congress, Proceedings, Part I, Vol. 458-468, 1953.

[2]Agricultural Statistics, 1952. U.S.D.A. Production in 1951 (Cattle and calves, milk) plus inventory value January 1, 1952 totalled about $27,000,000,000.; total livestock value (production and inventory) was about $40,000,000,000. These figures are interpreted only as an index to the proportionate value of the industry.

[3]The uses of these three anthelmintics are further described in numerous publications, of which the following may be most readily available: (1) Foster, A. O., and Enzie, F. D., Phenothiazine for the Control of Livestock Parasites; U.S.D.A. processed circ Feb., 1949. (2) Olsen, O. W., Liver Flukes in Cattle and How to Control Them by Medication; U.S.D.A. processed circ., Nov. 1944. (3) Foster, A. O., and Habermann, R. T., Lead Arsenate for removal of ruminant Tapeworms. *Jour. Am. Vet. Med. Assn.*, (July), 1948.

cacy against immature gastrointestinal helminths[3].

Before turning to a final comment on phenothiazine, it might be well to complete our principal story by taking a glance at the parasite picture in cattle. It shows some 40 species of helminths, in all, that are of more or less economic significance to this host[4]. The practitioner, at best, can resort to anthelmintics against fewer than half of these. No treatments can presently be recommended against the large American fluke, lancet flukes, threadworms, intestinal trichostrongyles, Cooperia species, thread-necked strongyles (Nematodirus), capillarids, whipworms, gullet worms, lungworms, and common filariae; and specific medication can be recommended only provisionally against hookworms. Adding these voids to present deficiencies, it is altogether apparent that much developmental research is needed on bovine anthelmintics. So far as the importance of bovine helminths is concerned, the only usable estimates,[5] however imperfect, suggest that the absolute economic loss may be more or less comparable to that attributable to helminthic disease of sheep. The estimates are in the order of $20,000,000. to $40,000,000., annually in each class, but rapidly accumulating information suggests that the bovine losses, in particular, may be much greater. Finally, since it is evident that phenothiazine is the one outstandingly useful anthelmintic for cattle, as it is also for sheep, goats, and horses, it seems in order to comment on the reported instances in which animals have been lost despite what appears, or is claimed, to have been adequate corrective medication. As a corollary to such misfortune, of course, confidence in phenothiazine has been shaken, and therefore other parasitized animals probably have been denied the benefit of this drug. The postmortem finding of heavy parasitism in cattle and calves that have been treated with phenothiazine is, consequently, doubly serious. It is also unfortunate, despite obviously complementary implications, that alleged failures of phenothiazine make news.

Regardless of explanations, the practical failures of phenothiazine, whether real or apparent, pose a problem that urgently requires solution. Obviously, this point is too involved for our present consideration, but all information that has come to this writer suggests that there is an illogical *non sequitor* in concluding that the drug is ineffective. Moreover, all published experience is against this conclusion. Indeed,if phenothiazine is properly administered, and due consideration is given to its indications and limitations, there is little, if any, probability of failure, barring the chance encountering of a phenothiazine-resistant strain of parasites. In 15 years, no such strain has been encountered in any animal. In short, if phenothiazine is not a good anthelmintic for cattle, then no other is more worthy. There are innumerable circumstances that might lead to the interpretation of anthelmintic failure, such as a mistaken identity of animals, a presumption that a particular drug was given when it was only "some treatment", the failure of boluses to disintegrate, treatment of moribund animals, errors in diagnosis, maintenance of animals under conditions of massive exposure, and improper dosage. Veterinarians can contribute immeasurably to a proper evaluation of phenothiazine and other drugs in cattle practice, and to solutions of the perplexing problems that constantly arise with any drug widely used. They are in a unique position to assure the proper use of specific anthelmintics and the necessary adjuvant measures of prevention or correction, to determine the prognosis in individual cases, to interpret results, to ascertain the true causes of alleged failures of treatment, and to evaluate all facts.

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Dr. C. D. Van Houweling, formerly assistant executive secretary of the A.V.M.A. and more recently associated as instructor at the College of Veterinary Medicine, University of Illinois, Urbana, has accepted the newly created position of director of livestock regulatory programs of the Agricultural Research Service of the United States Department of Agriculture in Washington, D. C.

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We are no longer dependent upon the Old World for animal plagues. We have now developed our own reservoirs, as proved by outbreaks in the recent past.

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Holt, of the Darlington Hall Cattle Breeding Center, by the addition of glycerol (gycerin) to processed diluted bovine semen claims to have obtained an overall increase of 4.3% in the conception rate.

[4]These and more were listed by Dikmans, G., Check List of the Internal and External Animal Uarasites of Domestic Animals in North America. *Am. Jour. Vet. Res.*, 6:211, 1945. More information about them is available in Dikmans, G., Internal Parasites of Cattle; Circ. No. 614 U.S.D.A., January 1942; Porter, D. A., Tapeworm and Roundworm Parasites of Cattle; Yearbook of Agriculture, 1942: 593-604; Foster, A. O., Parasites of Beef Cattle; *Hereford Jour.*, Jan. 1, 1945, and elsewhere.

[5]Although unpublished, the estimates given were the outcome of a diligent effort within the Department to evaluate losses due to parasites and disease.

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VETERINARY DIVISION, BRISTOL, TENN.

ITEMS OF VETERINARY INTEREST

Coccidia may be the cause of "sudden death" in calves or adult cattle.

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Broiler production reached 886,000,000 birds in 1952, totalling approximately 45% of that year's poultry meat crop.

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Great newspapers pride themselves on printing truths, all of them, impartially. It is apparent in many instances, particularly when subjects classified as medical appear in these publications, that the best qualified opinion is not sought.

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Artificial insemination of dairy cows has advanced inheritance factors for milk production more in 15 years than could have been expected by natural breeding for half a century.—*J. F. Hendricks.*

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Community chicken barbecues have become so popular in many areas that commercial catering services have developed to handle the demands of organizations, clubs, and private parties. One such company in Connecticut, organized on a non-profit basis, reported that during its first year of operation it handled 52 barbecues and served 15,000 people.

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California livestock officials have placed emergency restrictions on the movement of cattle into the state from Colorado, Arizona, and Texas. The action was said to be necessary because of scabies. Some 2,500 cattle originating from Colorado points were claimed to be infested and were dipped prior to release from holding pens.

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Pasteurella multocida is an ubiquitous bacterium found in numerous mammals and birds. Its role as a disease producer in mammals is controversial, but it is accepted as an etiological agent of pasteurellosis of many avian species. Latest reference to the disease in birds is that of Bivins (*Cornell Vet.*, 43:241, 1953) who describes a case in a starling. Bivins suggests that poultry diagnostic laboratories make surveys of feral (free-flying) birds to determine their role in transmitting this disease to domestic fowl.

Approximately one-third of the population of the United States is susceptible to poliomyelitis.

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Estimated value of livestock produced in Los Angeles County, California during 1953 is $153,895,765.

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Use of the word "surplus" appears to be taboo in Washington. Unwanted and costly agricultural commodities are now designated "excess reserves".

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The USDA Agricultural Marketing Service lists 760 establishments as officially approved poultry, domestic rabbit, and egg plants which operate under sanitation, grading and/or inspection programs of the service.

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The comments of Dr. Kenneth B. Haas, senior author of Business Practices in Veterinary Medicine, before the annual meeting of the Missouri Veterinary Medical Association were particularly enjoyable and interesting. Doctor Haas emphasized the importance of good client relationships for successful practice. He added that advances in the technic of human relations and matters that pertain to business practice have not kept pace with improvements in technical know-how and skill.

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New Fly Control Technic

Malathion, diazinon, and a dialkyl phosphate, three new insecticides, mixed with dry sugar and sprinkled in dairy barns give promise of more effective fly control. Investigators of the USDA report 90% reduction of fly population in four hours in Florida tests.

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Antibiotics in Swine Rations

Use of antibiotics in swine feeding is now quite well established. Most researchers on the problem agree that the action of these agents is one of inhibiting growth of microorganisms that inactivate growth factors.